ACS800 CraneDrive Control **Firmware Manual**

ACC800 Crane Application Program 7.1

for ACS 800 Frequency Converters

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for ACS 800 Frequency Converters

Firmware Manual

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Safety Instructions

Overview

These are safety instructions which must be followed when installing, operating and servicing the ACS 800. If neglected, physical injury and death may follow, or damage may occur to the frequency converter, the motor and driven equipment. The material in this chapter must be studied before attempting any work on, or with the unit.

Warnings and Notes

This manual distinguishes between two sorts of safety instructions. Warnings are used to inform of conditions that can, if proper steps are not taken, lead to a serious fault condition, physical injury and death. Notes are used when the reader is required to pay special attention or when there is additional information available on the subject. Notes are less crucial than Warnings, but should not be disregarded.

Warnings

Readers are informed of situations that can result in serious physical injury and/or serious damage to equipment with the following symbols:

Dangerous Voltage Warning: warns of situations in which a high voltage can cause physical injury and/or can damage equipment. The text next to this symbol describes ways to avoid the danger.

General Warning: warns of situations that can cause physical injury and/or can damage equipment by means other than electrical. The text next to this symbol describes ways to avoid the danger.

Electrostatic Discharge Warning: warns of situations in which an electrostatic discharge can damage equipment. The text next to this symbol describes ways to avoid the danger.

Notes

Readers are notified of the need for special attention or additional information available on the subject with the following symbols:

CAUTION! Caution aims to draw special attention to a particular issue.

Note: Note gives additional information or points out more information available on the subject.

General Safety Instructions

These safety instructions are intended for all work on the ACS 800. In addition to the instruction given below there are more safety instructions on the first pages of the *Hardware Manual.*

WARNING! All electrical installation and maintenance work on the ACS 800 should be carried out by qualified electricians.

The ACS 800 and adjoining equipment must be properly earthen

Do not attempt any work on a powered ACS 800. After switching off the mains, always allow the intermediate circuit capacitors 5 minutes to discharge before working on the frequency converter, the motor or the motor cable. It is good practice to check (with a voltage indicating instrument) that the frequency converter is in fact discharged before beginning work.

The ACS 800 motor cable terminals are at a dangerously high voltage when mains power is applied, regardless of motor operation.
There can be dangerous voltages inside the ACS 800 from external control circuits when the ACS 800 mains power is shut off. Exercise appropriate care when working with the unit. Neglecting these instructions can cause physical injury and death.

WARNING! The ACS 800 introduces electric motors, drive train mechanisms and driven machines to an extended operating range. It should be determined from the outset that all equipment is up to these conditions.

Operation is not allowed if the motor nominal voltage is less than one half of the ACS 800 nominal input voltage, or the motor nominal current is less than 1/6 of the ACS 800 nominal output current. Proper attention should be given to the motor insulation properties. The ACS 800 output comprises short, high voltage pulses (approximately 1.35 ... 1.5 * mains voltage) regardless of output frequency. This voltage can be increased up to 100 % by unfavourable motor cable properties. Contact an ABB office for additional information if multi-motor operation is required. Neglecting these instructions can result in permanent damage to the motor.

All insulation tests must be carried out with the ACS 800 disconnected from the cabling. Operation outside the rated capacities should not be attempted. Neglecting these instructions can result in permanent damage to the ACS 800.

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Note: Instructions for Electrical and Mechanical installation are not included in this manual. They can be found from the *ACS800-01/U1 Hardware Manual*, *ACS800-02/U2 Hardware Manual, ACS800-04/U4 Hardware Manual* or *ACS 600 Multidrive Hardware Manual.*

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Chapter 1 - Introduction to this Manual

1.1 Overview

This chapter describes the purpose, contents and the intended audience of this manual. It also explains the conventions used in this manual and lists related publications. This ACS 800 CraneDrive Control Fimware Manual is compatible with ACC 800 Application Software version 7.1 (signal 5.2 = ACAR71xx)

1.2 Before You Start

The purpose of this manual is to provide you with the information necessary to control and program your ACS 800 CraneDrive Control, from now on mentioned as the CraneDrive.

The audience for this manual is expected to have:
- Knowledge of standard electrical wiring practices, electronic components, and electrical schematic symbols.
- Minimal knowledge of ABB product names and terminology.

1.3 What This Manual Contains

Safety Instructions can be found on pages *i* and *ii* of this manual. The Safety Instructions describe the formats for various warnings and notations used in this manual. This chapter also states the general safety instructions which must be followed.

Chapter 1 – Introduction, the chapter you are reading now, introduces you to the *CraneDrive Firmware Manual* and conventions used throughout the manual.

Chapter 2 – Overview of CraneDrive Programming and CDP 312R Control Panel provides an overview of programming your CraneDrive. This chapter describes the operation of the CDP 312R Control Panel used for controlling and programming.

Chapter 3 – Start-up gives a Start-up procedure and also lists and explains the Start-up Data parameters.

Chapter 4 – Control Operation describes actual signals, keypad and external controls and external 24V power supply.

Chapter 5 – Crane Program Description defines the Crane program by describing the included crane specific functions and presenting them in a block diagram. This chapter also describes the User Macro function.

Chapter 6 – Parameters lists the CRANEDRIVE parameters and explains the functions of each parameter.

Chapter 7 - Fault Tracing describes the fault tracing procedure when warnings and faults are indicated. Warnings and faults are listed in tabular form with possible causes and remedies.

Appendix A - Complete Parameter and Default Settings lists, in tabular form, all parameter settings and the default values for the CraneDrive.

Appendix B - User I/O interface diagrams showing default I/O signal connections for Stand alone and Fieldbus modes.

1.4 Related Publications

In addition to this manual the CraneDrive user documentation includes the following manuals:

• *ACS800-01/U1 Hardware Manual* or *ACS800-02/U2 Hardware Manual*

• *ACS 800 Multidrive Hardware Manuals*

• *ACS800 Pulse encoder RTAC-01 User's manual* (optional)

• *ACS800 I/O Extension modules (RDIO-01 & RAIO-01) User's manuals* (optional)

• *ACS800 Fieldbus adapter module, User's manuals* (optional)

• *DriveWindow User's Manual* (optional)

New manuals will be prepared as more Option Modules and other optional extras become available. Please ask for them from the local ABB distributor.

Chapter 2 - Overview of CraneDrive Programming and the CDP 312R Control Panel

2.1 Overview

This chapter describes the programming principles of the CraneDrive; the operation of the CDP 312R Control Panel; and how to use the panel to modify parameters, measure actual values and control the drive(s).

2.2 CraneDrive Programming

The user can change the configuration of the CraneDrive to meet the needs of the requirements by programming. The CraneDrive is programmable through a set of parameters.

2.2.1 Application Macros

Parameters can be set one by one or a preprogrammed set of parameters can be selected. Preprogrammed parameter sets are called Application Macros. Refer to *Chapter 5 - Crane Program Description* for further information on Application Macros.

2.2.2 Parameter Groups

In order to simplify programming, parameters of the CraneDrive are organised into logical Groups. Parameters of the Start-Up Data Group are described in *Chapter 3 – Start-up Data* and other parameters in *Chapter 6 - Parameters*. Signals are described in the chapter 4.

Start-up Data Parameters

The Start-up Data parameters (Group 99) contains the basic settings needed to match the CraneDrive with your motor. This group also contains a list of preprogrammed Application Macros. The Start-up Data Group includes parameters that are set at start-up and should not need to be changed later on. Refer to *Chapter 3 – Start-up Data* for description of each parameter.

The Start-up Data Group is displayed as the first parameter group in the Parameter Mode. The correct procedure for selecting a parameter and changing its value is described in the paragraph *Keypad Modes - Parameter* Mode. Parameters are described in *Chapter 6 - Parameters*.

2.3 Control Panel

The CDP 312R Control Panel is the device used for locally controlling and programming the ACS 800. It can monitor and control up to 31 drives. The Panel can be attached directly to the door of the cabinet or it can be mounted, for example, in a control desk.

Panel Link

The CDP312R Drives Panel is connected to the drive through Modbus communication bus. Modbus, which is based on the RS485 standard, is a common bus protocol for ABB Drives products. The communication speed is 9600 bit/s. 31 drives and one panel can be connected on this bus. Each station must have a unique ID-number.

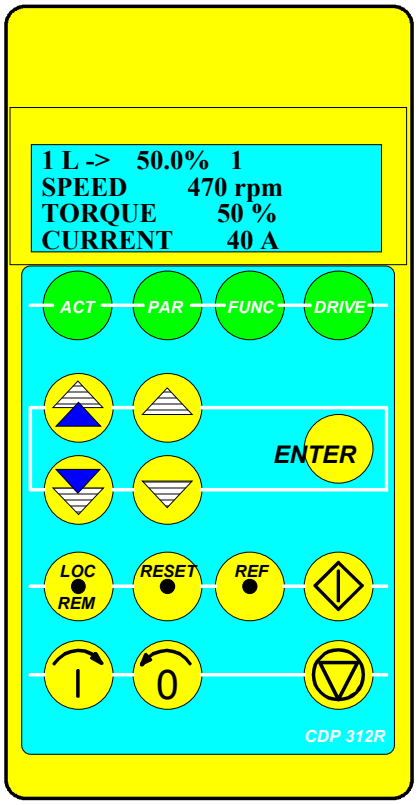


Figure 2-1 CDP 312R Control Panel

2.3.2 Display

The LCD type display has 4 lines of 20 characters.

The Control Panel display is an LCD type display of drive functions, drive parameter selections, and other drive information. Letters or numbers appear on the display according to which Control Panel keys are pressed.

2.3.3 Keys

The 16 Control Panel keys are flat, labeled, push-button keys that allow you to monitor drive functions, select drive parameters, and change drive macros and settings.

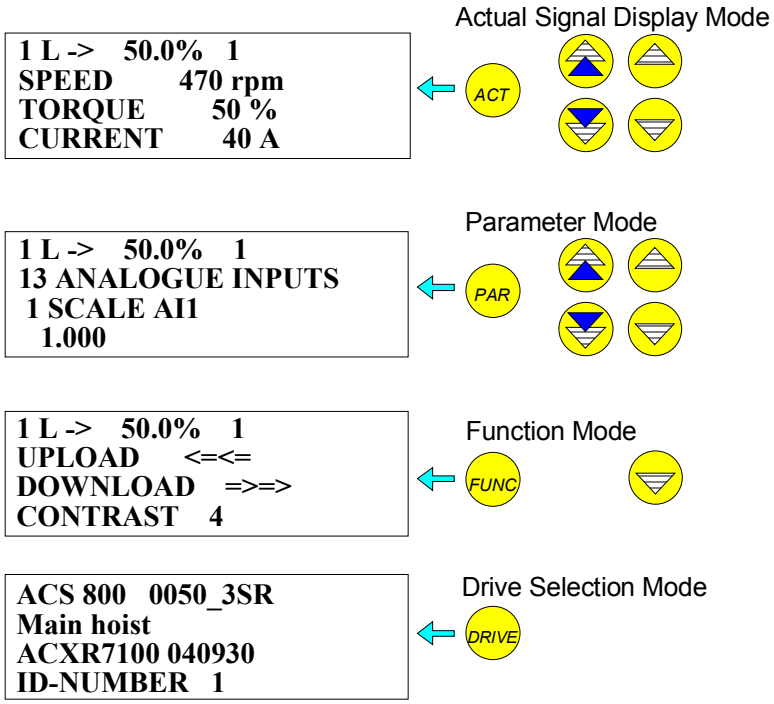


Figure 2-2 Control Panel Display indications and function of the Control Panel keys.

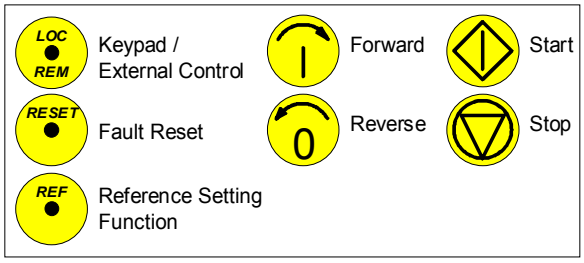


Figure 2-3 Operational commands of the Control Panel keys.

2.4 Panel Operation

The following is a description of the operation of the CDP 312R Control Panel. The Control Panel Keys and Displays are explained in Figures 2-1, 2-2 and 2-3.

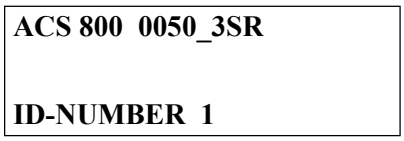
2.4.1 Keypad Modes

The CDP 312R Control Panel has four different keypad modes: Actual Signal Display Mode, Parameter Mode, Function Mode, and Drive Selection Mode. In addition to this there is a special Identification Display, which is displayed after connecting the panel to the link. The Identification Display and the keypad modes are described briefly below.

Identification Display

When the panel is connected for the first time, or the power is applied to the drive, the Identification Display appears showing the panel ID number and the number of drives connected to the link.

Note: The panel can be connected to the drive while power is applied to the drive.



After two seconds, the display will clear, and the Actual Signals of the selected drive will appear.

Actual Signal Display Mode

This mode includes two displays, the Actual Signal Display and the Fault History Display. The Actual Signal Display is displayed first when the Actual Signal Display mode is entered. If the drive is in a fault condition, the Fault Display will be shown first.

The panel will automatically return to Actual Signal Display Mode from other modes if no keys are pressed within one minute (exceptions: Status Display in Drive Selection Mode and Fault Display Mode).

In the Actual Signal Display Mode you can monitor three Actual Signals at a time. For more information of actual signals refer to *Chapter 4 Control Operation*. How to select the three Actual Signals to the display is explained in Table 2-3, page 2-6.

The Fault History (logger) includes information on the 64 most recent events, like faults, warnings and resets, that have occurred in your ACS 800. The 18 last events are backed up during RMIO power off. The name of the event and the total time since last RMIO power-on is displayed. If the AC800M (or AC80, AC4x0) overriding system has been connected to the drive (DDCS channel 0), this time can be seen in the date format instead of power-on time. The procedure for clearing the Fault History is described in Table 2-4, page 2-7.

The following table shows the events that are stored in the Fault History. For each event it is described what information is included.

Table 2-1 Events stored in the Fault History

Event	***Information***	***Display***
A fault is detected by ACS 800	Sequential number of the event. Name of the fault and a "+" sign in front of the name. Total power on time or date and time updated by overriding system.	**1 L -> 0.0% 0** **2 LAST FAULT** **+OVERVOLTAGE** **1121 H 1 MIN 23 S**
A fault is reset by user.	Sequential number of the event. -RESET FAULT text. Total power on time or date and time updated by overriding system.	**1 L -> 0.0% 0** **1 LAST FAULT** **-RESET FAULT** **1121 H 1 MIN 23 S**
A warning is activated by ACS 800	Sequential number of the event. Name of the fault and a "+" sign in front of the name. Total power on time or date and time updated by overriding system.	**1 L -> 0.0% 0** **1 LAST WARNING** **+JOYSTICK** **1121 H 1 MIN 23 S**
A warning is deactivated by ACS 800	Sequential number of the event. Name of the warning and a "-" sign in front of the name. Total power on time or date and time updated by overriding system.	**1 L -> 0.0% 0** **1 LAST WARNING** **-JOYSTICK** **1121 H 1 MIN 23 S**

When a fault or warning occurs in the drive, the message will be displayed immediately, except in Drive Selection Mode. Table 2-5, page 2-7, shows how to reset a fault. Refer to chapter 7 for information on fault tracing. From the fault display, it is possible to change to other displays without resetting the fault. If no keys are pressed the fault or warning text is displayed as long as the fault exists.

Table 2-2 How to display the full name of the three Actual Signals.

Step	Function	Press key	Display after key is pressed
1.	To display the full name of the three actual signals	**Hold** ACT	1 L -> 50.0% 1 MOTOR SPEED FILT MOTOR TORQUE FILT MOTOR CURRENT
2.	To return to the Actual Signal Display Mode	**Release** ACT	1 L -> 50.0% 1 SPEED 470 rpm TORQUE 50 % CURRENT 40 A

Table 2-3 How to select Actual Signals to the display.

Step	Function	Press key	Display after key is pressed
1.	To enter the Actual Signal Display Mode	ACT	1 L -> 50.0% 1 SPEED 470 rpm TORQUE 50 % CURRENT 40 A
2.	To select the desired row.	▲ ▼	1 L -> 50.0% 1 SPEED 470 rpm TORQUE 50 % CURRENT 40 A
3.	To enter the Actual Signal Selection Mode.	ENTER	1 L -> 50.0% 1 1 ACTUAL SIGNALS 5 TORQUE 50 %
4.	To select a different group.	▲▲ ▼▼	1 L -> 50.0% 1 2 INT SIGNALS 1 SP REF 2 470 rpm
5.	To select a index.	▲ ▼	1 L -> 50.0% 1 2 INT SIGNALS 3 SP REF 4 470 rpm
6a. **or** 6b.	To accept the selection and to return to the Actual Signal Display Mode. To cancel the selection and keep the original selection, press any of the Mode keys. The selected Keypad Mode is entered.	ENTER ACT PAR FUNC DRIVE	1 L -> 50.0% 1 SPEED 470 rpm SP REF 4 470 rpm CURRENT 40 A 1 L -> 50.0% 1 SPEED 470 rpm TORQUE 50 % CURRENT 40 A

Table 2-4 How to display a fault and reset the Fault History.

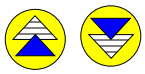
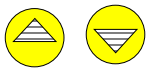
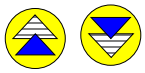
Step	Function	Press key	Display after key is pressed
1.	To enter the Actual Signal Display Mode	ACT	1 L -> 50.0% 1 SPEED 470 rpm TORQUE 50 % CURRENT 40 A
2.	To enter the Fault History Display. Logging time can be seen either total power-on time or in the date format, if overriding system (ex. AC80) has been connected to control the drive.		1 L -> 50.0% 1 1 LAST FAULT +OVERCURRENT r 6451 H 21 MIN 23 S
3.	To select previous (UP) or next fault (DOWN).		1 L -> 50.0% 1 2 LAST FAULT +OVERVOLTAGE r 1121 H 1 MIN 23 S
	To clear the Fault History. After the fault text there is letter r or s indicating the status of the fault: s = set r = reset The Fault History is empty. **Note!** An active fault does not clear a fault in the logger	RESET	1 L -> 50.0% 1 2 LAST FAULT H MIN S
4.	To return to the Actual Signal Display Mode.		1 L -> 50.0% 1 SPEED 470 rpm TORQUE 50 % CURRENT 40 A

Table 2-5 How to display and reset an active fault.

Step	Function	Press key	Display after key is pressed
1.	To enter the Actual Signal Display Mode.	ACT	1 L -> 50.0% 1 ACS 800 75 kW ** FAULT ** ACS 800 TEMP
2.	To reset the fault. Reset button functions also in the REMOTE mode.	RESET	1 L -> 0.0% 1 SPEED 0 rpm TORQUE 0 % CURRENT 0 A

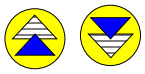
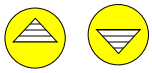
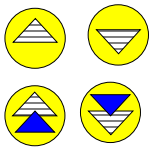
Parameter Mode

The Parameter Mode is used to make changes to the CraneDrive parameters. When this mode is entered for the first time after power up, the display will show the first parameter of the first group. Next time the Parameter Mode is entered, the previously selected parameter is shown.

NOTE: If you try to write to a write-protected parameter, the following warning will be displayed:

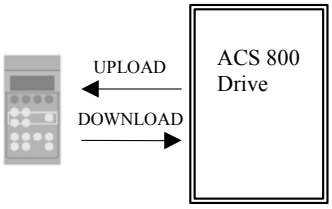
```
** WARNING **
WRITE ACCESS DENIED
PARAMETER SETTING
NOT POSSIBLE
```

Table 2-6 How to select a parameter and change the value.

Step	***Function***	***Press key***	***Display after key is pressed***
1.	To enter the Parameter Mode Selection	PAR	1 L -> 50.0% 1 13 ANALOGUE INPUTS 1 SCALE AI1 1.000
2.	To select another parameter group. While holding the arrow down, only the group name and number are displayed. When the key is released, name, number and value of the first parameter in the group are displayed.		1 L -> 50.0% 1 13 ANALOGUE INPUTS 1 SCALE AI1 1.000 1 L -> 50.0% 1 14 RELAY OUPUTS 1 RELAY RO1 OUTPUT BRAKE LIFT
3.	To select a index. While holding the arrow down, only the parameter name and number are displayed. When the key is released the value of the parameter is also displayed.		1 L -> 50.0% 1 14 RELAY OUPUTS 3 RELAY RO3 OUTPUT FAULT-N
4.	To enter the Parameter Setting Mode.	ENTER	1 L -> 50.0% 1 14 RELAY OUPUTS 3 RELAY RO3 OUTPUT [FAULT-N]
5.	To change the parameter value. (slow change) (fast change)		1 L -> 50.0% 1 14 RELAY OUPUTS 3 RELAY RO3 OUTPUT [CONTROL LOC]
6a. **or** 6b.	To send a new value to the drive. To cancel the new setting and keep the original value. The selected Keypad Mode is entered.	ENTER ACT PAR FUNC DRIVE	1 L -> 50.0% 1 14 RELAY OUPUTS 3 RELAY RO3 OUTPUT CONTROL LOC 1 L -> 50.0% 1 13 ANALOGUE INPUTS 1 SCALE AI1 1.000

Function Mode

The Function Mode is used to select special functions. These functions include Parameter Upload, Parameter Download and setting the contrast of the CDP 312R Control Panel display.



Parameter Upload will copy all parameters and the results of motor identification from the drive to the panel. The upload function can be performed while the drive is running. Only the STOP command can be given during the uploading process.

By default, Parameter Download will copy existing parameter Groups 10 to 97 stored in the panel to the drive.

Note: Parameters in Groups 98 and 99 concerning options, macro and motor data, and also ID Run data are not copied.

Table 2-7, page 2-10, describes how to select and perform Parameter Upload and Parameter Download functions.

Uploading has to be done before downloading. If downloading is attempted before uploading, the following warning will be displayed:

```
** WARNING **
NOT UPLOADED
DOWNLOADING
NOT POSSIBLE
```

The parameters can be uploaded and downloaded only if the software package version and application software version(see signal 5.01 SW PACKAGE VERSION and 5.02 APPL SW VERSION) of the destination drive are the same as the software version of the source drive. Otherwise the following warning will be displayed:

```
** WARNING **
DRIVE INCOMPATIBLE
DOWNLOADING
NOT POSSIBLE
```

The drive must be stopped during the downloading process. If the drive is running and downloading is selected, the following warning is displayed:

```
** WARNING **
DRIVE IS RUNNING
DOWNLOADING
NOT POSSIBLE
```

Table 2-7 How to select and perform a function.

Step	Function	Press key	Display after key is pressed
1.	To enter the Function Mode.	FUNC	1 L -> 0.0% 0 UPLOAD <=<= DOWNLOAD =>=> CONTRAST 4
2.	To select a function (a blinking cursor indicates the selected function).	▲ ▼	1 L -> 0.0% 0 UPLOAD <=<= DOWNLOAD =>=> CONTRAST 4
3.	To activate the selected function.	ENTER	1 L -> 0.0% 0 =>=>=>=>=>=>=> DOWNLOAD
4.	Loading completed.		1 L -> 0.0% 0 SPEED 470 rpm TORQUE 50 % CURRENT 40 A

Table 2-8 How to set the contrast of the panel display.

Step	Function	Press key	Display after key is pressed
1.	To enter the Function Mode.	FUNC	1 L -> 0.0% 0 UPLOAD <=<= DOWNLOAD =>=> CONTRAST 4
2.	To select a function.	▲ ▼	1 L -> 0.0% 0 UPLOAD <=<= DOWNLOAD =>=> CONTRAST 4
3.	To enter contrast setting function.	ENTER	1 L -> 0.0% 0 CONTRAST [4]
4.	To set the contrast. (0...7)	▲ ▼	1 L -> 0.0% 0 CONTRAST [6]
5a. **or** 5b.	To accept the selected value To cancel the new setting and keep the original value, press any of the Mode keys. The selected Keypad Mode is entered.	ENTER ACT PAR FUNC DRIVE	1 L -> 0.0% 0 UPLOAD <=<= DOWNLOAD =>=> CONTRAST 6 1 L -> 0.0% 0 UPLOAD <=<= DOWNLOAD =>=> CONTRAST 4

Copying parameters from one unit to other units

You can copy parameters 10...97 from one drive to another by using the Parameter Upload and Parameter Download functions in the Function Mode. Typically this kind of function can be used if the processes and the motor types are same. This procedure is permitted only if the sw-versions are same. Follow the procedure below:

1. Select the correct options (Group 98) and macro (Group 99) for **each drive.**

2. Set the rating plate values for the motors (Group 99) and perform the identification run for each motor if required (see page **Error! Reference source not found.Error! Bookmark not defined.**).

3. Set the parameters in Groups 10 to 97 as preferred in one ACC 800 drive.

4. Upload the parameters from the CraneDrive to the panel (see Table 2-7).

5. Disconnect the panel and reconnect it to the next CraneDrive unit.

6. Ensure the target CraneDrive is in Local control (L shown on the first row of the display). If necessary, change the control location by pressing LOC REM.

7. Download the parameters from the panel to the CraneDrive unit (see Table 2-7).

8. Repeat steps 5 and 6 for the rest of the units.

Note: Parameters in Groups 98 and 99 concerning options, macro and motor data are not copied.[1)]

Setting the contrast

If the Control Panel Display is not clear enough, set the contrast according to the procedure explained in Table 2-8.

71. The restriction prevents downloading of incorrect motor data (Group 99). In special cases it is also possible to upload and download Groups 98

and 99 and the results of motor identification.
For more information, please contact your local ABB representative.

Drive Selection Mode

In normal use the features available in the Drive Selection Mode are not needed; these features are reserved for applications where several drives are connected to one Modbus Link.

Modbus Link is the communication link connecting the Control Panel and the CraneDrive. Each on-line station must have an individual identification number (ID). By default, the ID number of the CraneDrive is 1.

CAUTION! The default ID number setting of the CraneDrive should not be changed unless it is to be connected to the Modbus Link with other drives on-line.

Table 2-9 How to select a drive and change ID number.

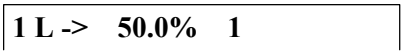
Step	Function	Press key	Display after key is pressed
1.	To enter the Drive Selection Mode	DRIVE	ACS 800 0005_3 Trolley ACXR7100 040930 ID-NUMBER 1
2.	To select the next view. The ID number of the station is changed by first pressing ***ENTER*** (the brackets round the ID number appear) and then adjusting the value with arrow buttons ▲ ▼. The new value is accepted with ***ENTER***. The power of the CraneDrive must be switched off to validate its new ID number setting (the new value is not displayed until the power is switched off and on. The Status Display of all devices connected to the Panel Link is shown after the last individual station. If all stations do not fit on the display at once, press ▲ to view rest of them.	▲	ACS 800 0005_3 Trolley ACXR7100 040930 ID-NUMBER 1 1 á 2 Ñ 3 Ü 4 Ö 5 Ö 6 á 7 F 8 Ö 9 Ö 10 Ö á = Drive stopped, direction forward Ñ = Drive running, direction reverse F = Drive has tripped on a fault
3.	To connect to the last displayed drive and enter another mode, press one of the Mode keys. The selected Keypad Mode is entered.	ACT PAR FUNC	1 L -> 50.0% 1 SPEED 470 rpm TORQUE 50 % CURRENT 40 A

2.4.2 Operational Commands

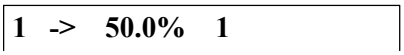
Operational commands control the operation of the CraneDrive. They include starting and stopping the drive, changing the direction of rotation and adjusting the reference. The reference value is used for controlling the motor speed.

Changing control Location

Operational commands can be given from the CDP 312R Control Panel always when the status row is displayed and the control location is the panel. This is indicated by L (Local Control) on the display. See the following figure.



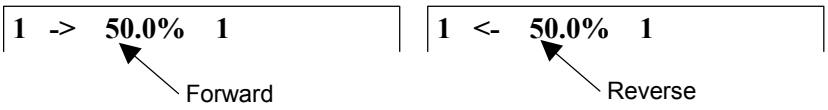
Remote Control (control from the overriding system or I/O is indicated by empty field. See the following figure.



Operational commands cannot be given from this panel when in Remote Control. Only monitoring actual signals, setting parameters, uploading and changing ID numbers is possible.

The control is changed between Keypad and External control locations by pressing the ***LOC / REM*** key. Changing control location only possible while motor is stopped. Only one of the Local Control devices (CDP 312R or Drives Window) can be used as the local control location at a time. Refer *to Chapter 4 - Control Operation* for the explanation of Keypad and External control.

Direction of actual rotation is indicated by an arrow.



Start, Stop Direction and Reference

Start, Stop and Direction commands are given from the panel by pressing the keys

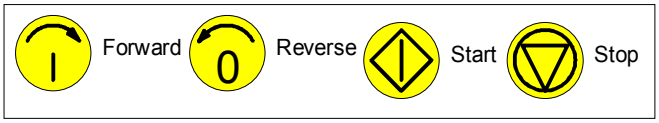
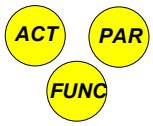
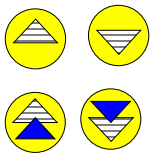
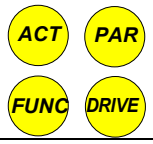


Table 2-10 explains how to set the Reference from the panel.

Table 2-10 How to set the reference.

Step	Function	Press key	Display after key is pressed
1.	To display enter a Keypad Mode displaying the status row.		1 L -> 50.0% 1 SPEED 470 rpm TORQUE 50 % CURRENT 40 A
2.	To enter the Reference Setting Mode		1 L -> [50.0%] 1 SPEED 470 rpm TORQUE 50 % CURRENT 40 A
3.	To change the reference. (slow change): (fast change):		1 L -> [56.0%] 1 SPEED 526 rpm TORQUE 50 % CURRENT 40 A
4.	To escape the Reference Setting Mode. The selected Keypad Mode is entered.		1 L -> 56.0% 1 SPEED 526 rpm TORQUE 50 % CURRENT 40 A

Chapter 3 - Start-up

3.1 Overview

This chapter lists and explains the Start-up Procedure and the Start-up Data Parameters. The Start-up Data Parameters are a special set of parameters that allow you to set up the CraneDrive and motor information. Start-up Data Parameters should only need to be set during start-up and should not need to be changed afterwards.

3.2 Start-up Procedure

The start-up procedure of CraneDrive frequency converters equipped with Standard or CraneDrive Application Program is described in this chapter.

WARNING! All electrical installation and maintenance work described in this chapter should only be undertaken by a qualified electrician. The Safety Instructions on the first pages of this manual and appropriate hardware manual must be followed.

Refer to Chapter 7 – Fault Tracing in case of trouble.

START-UP FLOWCHART	
SAFETY	
❑	**The start-up procedure should only be carried out by a qualified electrician.**
❑	**Follow the safety instructions on the first pages of this manual during the start-up procedure.**
❑	**Check the installation before the start-up procedure. Refer to Installation Checklist in hardware manual.**
❑	Check that starting the motor does not cause any danger. It is recommended having the driven equipment disengaged when first start is performed if there is the risk of damage to the driven equipment in case of incorrect rotation direction of the motor.

START-UP FLOWCHART

1 – POWER-UP

❑ **Apply mains power. The ACS 800 should not be powered up more than five times in ten minutes to avoid charging resistor overheating** (no limitation for ACS 600 MultiDrive units).

```
CDP312 PANEL
ID NUMBER 31

TOTAL 12 DRIVES
```

The Control Panel enters the Identification Display.

The Control Panel enters the Actual Signal Display Mode automatically in a few seconds.

```
1 L ->    0.0%   0
SPEED        0 rpm
TORQUE       0 %
CURRENT      0 A
```

2 – START-UP DATA ENTERING

❑ **Select the Application Macro.**
Press ***PAR*** key.

```
1 L ->    0.0%   0
99 START-UP DATA
 2 APPLICATION MACRO
   CRANE
```

Press ***ENTER***. Square brackets appear around the parameter value. Scroll available options with ▲ and ▼. Accept the selection with ***ENTER***.

```
1 L ->    0.0%   0
99 START-UP DATA
 2 APPLICATION MACRO
  [CRANE]
```

A detailed description of the Application Macros is included in Chapter 5.

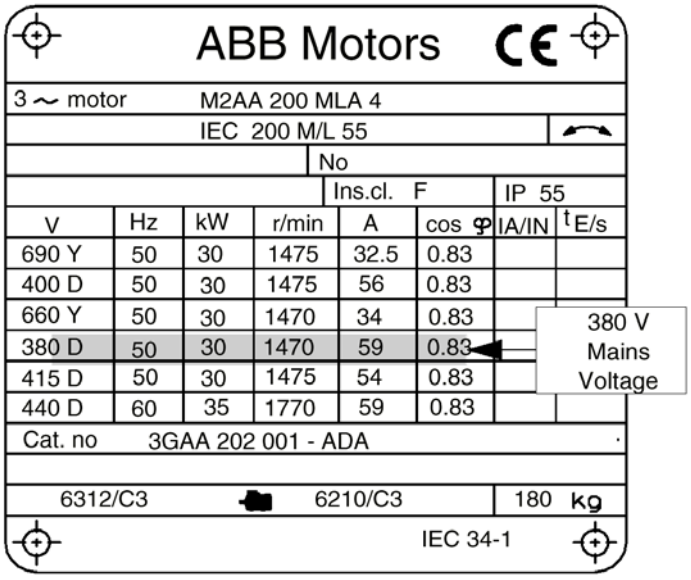
❑ **Select the motor control mode.** DTC is suitable in most cases.

```
1 L ->    0.0%   0
99 START-UP DATA
 4 MOTOR CTRL MODE
  [DTC]
```

START-UP FLOWCHART

Enter the motor data from the motor nameplate.

Note: Use the motor´s (continuous duty) data = true electrical data. If nameplate is showing only duty cycle data e.g. S3-60% data, please contact motor manufacturer for S1 data.



❑ Nominal voltage

Press ***PAR*** key. Press ▽ to move to Parameter 99.5.

Press ***ENTER***. Enter the value by △ and ▽ . Press ***ENTER***.
Allowed range: ½ · U_N ... 2 · U_N of ACS 800. (U_N refers to the highest voltage in each of the nominal voltage ranges: 415 VAC for 400 VAC units, 500 VAC for 500 VAC units and 690 VAC for 600 VAC units.)

Note: Enter exactly the value given on the nameplate. Repeat the procedure for the following parameters:

Nominal current 99.6
Allowed range: 1/6 · Ihd ... 2 · Ihd of ACS 800

Nominal frequency 99.7
Range: 8 ... 300 Hz

```
1 L ->     0.0%    0
99 START-UP DATA
 5 MOTOR NOM VOLTAGE
 [ ]
```

```
1 L ->     0.0%    0
99 START-UP DATA
 6 MOTOR NOM CURRENT
 [ ]
```

```
1 L ->     0.0%    0
99 START-UP DATA
 7 MOTOR NOM FREQ
 [ ]
```

START-UP FLOWCHART

❑	Nominal speed 99.8 Range: 1 ... 18000 rpm **Set the motor data exactly the same as on the motor nameplate (should be the rated *full-load* speed). For example, if the motor nominal speed is 1440 rpm on the nameplate, setting the value of Parameter 99.8 MOTOR NOM SPEED to 1500 rpm (e.g. no-load speed) results in wrong operation of the drive.**	**1 L -> 0.0% 0** **99 START-UP DATA** **8 MOTOR NOM SPEED** **[ ]**
❑	Nominal power 99.9 Range: 0 ... 9000 kW	**1 L -> 0.0% 0** **99 START-UP DATA** **9 MOTOR NOM POWER** **[ ]**
	When the motor data has been entered a warning appears. It indicates that the motor parameters have been set, and the CraneDrive is ready to start the motor indentification (ID magnetisation or ID Run). Press ***PAR*** to go to the next parameter 99.10 Motor ID Run.	**1 L -> 0.0% 0** **STANDARD DRIVE** **** WARNING **** **ID MAGN REQ**
❑	Motor ID Run 99.10 Selection ID MAGN is sufficient for less demanding travel drives. The next step of this flowchart is performed with Motor ID Run selection ID MAGN. Motor identification magnetisation is performed instead of Motor ID Run. Motor ID Run is recommended for hoist drives. Motor Identification Run (ID Run) can be performed to enhance the mathematical model of the motor. This is required e.g. in demanding motor control applications when no pulse encoder feedback is used, as 100 % motor control accuracy is usually only achieved with the ID Run. Refer to *Section 3 – Start-up Data* for performance procedure of the ID Run.	**1 L -> 0.0% 0** **99 START-UP DATA** **10 MOTOR ID RUN** **[ID MAGN]**

START-UP FLOWCHART

71.□ – IDENTIFICATION MAGNETISATION with Motor ID Run selection ID MAGN

❑ Press the key. The motor is magnetised at zero speed. Duration approximately 10 to 60 s.

```
1 L ->    0.0%   1
STANDARD DRIVE
** WARNING **
ID MAGN
```

```
1 L ->    0.0%   0
STANDARD DRIVE
** WARNING **
ID DONE
```

4 – ROTATION DIRECTION OF THE MOTOR

❑ Increase the speed reference from zero to a small value: Press ***ACT***, ***PAR*** or ***FUNC*** key to enter Keypad Mode with the status row visible. Change the Speed Reference value by pressing ***REF*** and then or . Press (Start) to start the motor. Check that the motor is running in the desired direction. Stop the motor by pressing .

```
1 L ->  [ xx.x]%  1
SPEED       xxxx rpm
TORQUE       xx %
CURRENT      xx A
```

To change the rotation direction of the motor:

71.□ Disconnect mains power from the CraneDrive, and wait 5 minutes for the intermediate circuit capacitors to discharge. Measure the voltage between each input terminal (U1, V1 and W1) and earth with a multimeter to ensure that the frequency converter is discharged.

2. Exchange the position of two motor cable phase conductors at the motor terminals or at the motor connection box.

3. Verify your work by applying mains power and repeating the check as described above.

71.□

START-UP FLOWCHART

5 – SPEED LIMITS AND ACCELERATION/DECELERATION TIMES

❑ Press ***PAR***. Use ▲▲ and ▲ to scroll parameters.

Minimum speed

Enter the value by ***ENTER*** and ▲ or ▼. Press ***ENTER***. Repeat the procedure for the following parameters:

```
1 L ->    0.0%    0
20 LIMITS
 1 MINIMUM SPEED
  [ ]
```

Maximum speed

```
1 L ->    0.0%    0
20 LIMITS
 2 MAXIMUM SPEED
  [ ]
```

Acceleration times

```
1 L ->    0.0%    0
69 REFERENCE HANDLER
 2 ACC TIME FORW
  [ ]
```

```
1 L ->    0.0%    0
69 REFERENCE HANDLER
 3 ACC TIME REV
  [ ]
```

Deceleration times

```
1 L ->    0.0%    0
69 REFERENCE HANDLER
 4 DEC TIME FORW
  [ ]
```

```
1 L ->    0.0%    0
69 REFERENCE HANDLER
 5 DEC TIME REV
  [ ]
```

For other parameters see Chapter 5 – Parameter setting tables 5-1 and 5-2.

3.3 Start-up Data

3.3.1 Start-up Data Parameters

To access the Start-up Data Parameters you must enter the Parameter Mode. The Start-up Data Parameters appear on the display (Parameter Group 99). After the Start-up parameters for the motor are set, the display shows the last edited Parameter Group when entering Parameter Mode and no longer returns to the Parameter Group 99.

In the Start-up Data group there are parameters for selecting the Application Macro and the Motor Information Parameters containing the basic settings required to match the CraneDrive with your motor.

When changing the value of the Start-up Data Parameters, follow the procedure described in Chapter 2 - Overview of CraneDrive Programming, Table 2-6, page 2-8. Table 3-1, page 3-8, lists the Start-up Data Parameters. The Range/Unit column in Table 3-1 shows the parameter values, which are explained in detail below the table.

NOTE: The drive will not start, if the Start-up Data Parameters have not been changed from the factory settings or the nominal current of the motor is too small compared to the nominal current of the inverter. The following warning will be displayed:

**** WARNING **** **NO MOT DATA**

If the Motor Control Mode (Parameter 99.4) is set to SCALAR, the comparison between the nominal current of the motor and the nominal current of the inverter is not made.

WARNING! Running the motor and the driven equipment with incorrect start-up data can result in improper operation, reduction in control accuracy and damage to equipment.

Table 3-1 Group 99, Start-up Data Parameters.

Parameter	***Range/Unit***	***Description***
1 LANGUAGE	Languages	Display language selection.
2 APPLICATION MACRO	Application macros	Application macro selection.
3 APPLIC RESTORE	NO; YES	Restores parameters to factory setting values.
4 MOTOR CTRL MODE	DTC; SCALAR	Motor control mode selection.
5 MOTOR NOM VOLTAGE	½ * U_N of ACS 800 ... 2 * U_N of ACS 800	Nominal voltage from the motor rating plate.
6 MOTOR NOM CURRENT	1/6 * I_{hd} of ACS 800 ... 2 * I_{hd} of ACS 800	Matches the ACS 800 to the rated (S1) motor current.
7 MOTOR NOM FREQ	8 ... 300 Hz	Nominal frequency from the motor rating plate.
8 MOTOR NOM SPEED	1 ... 18 000 rpm	Nominal speed from the motor rating plate.
9 MOTOR NOM POWER	0 ... 9000 kW	Nominal (S1) power from the motor rating plate.
10 MOTOR ID RUN?	ID MAGN; STANDARD; REDUCED	Selects the motor ID self-tune run. **NOTE: This will cause the motor to operate after start command.**
11 DEVICE NAME	“free text”	Drive section name, e.g. “Main Hoist”.

Parameter Selection

The following is a list of the Start-up Data Parameters with a description of each parameter. **The motor data parameters 99.5 ... 99.9 are always to be set at start-up.**

1 LANGUAGE The ACS 800 displays all information in the language you select. The 13 alternatives are: English, American English, German, Italian, Spanish, Portugese, Dutch, French, Danish, Finnish, Swedish, Czech and Polish. **Please note that for ACC 800 sw version 7.1 only following languages are available: English, German, French, Spanish and Finnish.**

2 APPLICATION MACRO This parameter is used to select between the **CRANE** macro, for crane drive functions but not including Master/Follower bus communication, and the **M/F CTRL** macro with the crane drive functions plus Master/Follower bus communication.. Refer to *Chapter 5 – Crane Program Description*, for a description of the two available Macros. There is also a selection for saving the current parameter settings as a User Macro (USER 1 SAVE or USER 2 SAVE), and recalling these settings (USER 1 LOAD or USER 2 LOAD).

Parameter group 99 is not included in CRANE and M/F CTRL macros. The parameter settings will remain the same even though the macro is changed.

NOTE: User Macro load restores also the motor settings of the Start-up Data group and the results of the Motor ID Run. Check that the settings correspond to the motor used.

3 APPLIC RESTORE Selection Yes restores the original settings of an application macro as follows:
- If application macro CRANE or M/F CTRL is selected, the parameter values are restored to the settings loaded at the factory. Exceptions: Parameter setting in groups 50, 51, 98 and 99 remain unchanged.
- If User Macro 1 or 2 is selected, the parameter values are restored to the last saved values. In addition, the results of the motor identification run are restored (see Chapter 5). Exceptions: Parameter setting in groups 50, 51 and 98 remain unchanged.

4 MOTOR CTRL MODE This parameter sets the motor control mode.

DTC

The DTC (Direct Torque Control) mode is suitable for most applications. The CraneDrive performs precise speed and torque control of standard squirrel cage motors. Pulse encoder feedback is required on all Crane Hoist Drives.

In multi-motor applications the nominal voltage of each motor has to be equal to the nominal voltage of the inverter and the nominal frequency of each motor must be the same. The sum of the motor nominal currents has to fall within the limits specified at Parameter 99.6 (MOTOR NOMINAL CURRENT).

SCALAR

The SCALAR control mode is recommended for multi-motor drives when number of motors connected to the CraneDrive is variable. The SCALAR control is also recommended when the nominal current of the motor is less than 1/6 of the nominal current of the inverter or the inverter is used for test purposes with no motor connected.

With SCALAR control the drive is not as effective as with DTC control. The differences between the SCALAR and DTC control modes are discussed further in this manual in relevant parameter lists.

The motor identification run, torque control, and motor phase loss check (Parameter 30.10) are disabled in the SCALAR control mode.

5 MOTOR NOM VOLTAGE This parameter matches the CraneDrive with the nominal voltage of the motor as indicated on the motor rating plate. It is not possible to start the CraneDrive without setting this parameter.

Note: It is not allowed to connect a motor with nominal voltage less than ½ * U_N or more than 2 * U_N where U_N is either 415 V, 500 V or 690 V depending on the voltage rating of the ACS 800 used.

6 MOTOR NOM CURRENT

This parameter matches the ACS 800 to the rated motor current. The allowed range 1/6 * I_{hd} of ACS 800 ... 2 * I_{hd} of ACS 800 is valid for DTC motor control mode. In SCALAR mode the allowed range is 0 * I_{hd} of ACS 800 ... 3 * I_{hd} of ACS 800.

Correct motor run requires that the magnetising current of the motor does not exceed 90 per cent of the nominal current of the inverter.

7 MOTOR NOM FREQUENCY

This parameter matches the ACS 800 to the rated motor frequency, adjustable from 8 Hz to 300 Hz.

8 MOTOR NOM SPEED

This parameter matches the ACS 800 to the nominal speed as indicated on the motor rating plate

---

NOTE: It is very important to set this parameter in order to achieve the best possible accuracy in speed control.

---

9 MOTOR NOM POWER

This parameter matches the ACS 800 to the rated power of the motor, adjustable between 0.5 kW and 9000 kW.

10 MOTOR ID RUN

This parameter is used to initiate the Motor Identification Run. During the run, the ACS 800 will identify the characteristics of the motor for optimum motor control. The ID Run takes about one minute.

NOTE: Torque monitor and Torque proving is automatically disabled during ID Magn (first start) and ID Run. Other optional crane functions like: Power optimisation and Torque memory should also be disabled during ID Run!

Any change of limitations (Parameter Group 20) should be done after performing the Motor ID Run (Use default values). These limits may affect the result of the ID Run.

ID MAGN

The Motor ID Run is not performed. This can be selected in most applications. The motor model is calculated at first start by magnetising the motor for 10 to 60 s at zero speed.

Note: The ID Run (Standard or Reduced) should be selected if:

- operation point is near zero speed
- operation at torque range above the motor nominal torque within wide speed range and without any pulse encoder (i.e. without any measured speed feedback) is required

STANDARD

Performing the Standard Motor ID Run guarantees that the best possible control accuracy is achieved. The motor must be decoupled from the driven equipment before performing the Standard Motor ID Run.

REDUCED

The Reduced Motor ID Run should be selected instead of the Standard ID Run:

- if mechanical losses are higher than 20 % (i.e. the motor cannot be de-coupled from the driven equipment)
- if flux reduction is not allowed while the motor is running (i.e. there are auxiliary devices connected in parallel with the motor)

NOTE: Check the rotation direction of the motor before starting the Motor ID Run. During the run the motor will rotate in the forward direction.

WARNING! The motor will run at up to approximately 50 % ... 80 % of the nominal speed during the Motor ID Run. BE SURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE MOTOR ID RUN!

To perform the Motor ID Run (Drive must be in LOCAL mode):

Note: If parameter values (Group 10 to 98) are changed before the ID Run, check that the new settings meet the following conditions:

- 20.1 MINIMUM SPEED < 0
- 20.2 MAXIMUM SPEED > 80 % of motor rated speed
- 20.3 MAXIMUM CURRENT A > 100 % I_{hd} (Amp)
- 20.4 MAXIMUM TORQUE > 50 %

71.□ Change the selection to STANDARD or REDUCED:

```
1 L ->     0.0%    0
99 START-UP DATA
10 MOTOR ID RUN
[STANDARD]
```

71.□ Press **ENTER** to verify selection.
The following message will be displayed:

```
1 L ->     0.0%    0
ACS  800  75 kW
** WARNING **
ID-RUN SEL
```

3) To start the ID Run, press the ⓓ key. The Power On Ackn input (e.g. DI2, see parameter 10.5) must be active if used.

Warning during the ID Run:

```
1 L ->    11.3%    1
ACS  800  75 kW
** WARNING **
MOTOR STARTS
```

Warning after a succesfully completed ID Run:

```
1 L ->    11.3%    1
ACS  800  75 kW
** WARNING **
 ID DONE
```

After completing the ID Run, the Actual Signal Display mode is entered by pressing the RESET key.

The Motor ID Run can be stopped at any time by pressing the Control Panel ⊽ key.

Pressing any other key than **ACT**, **FUNC** or **DRIVE** while the previous warning messages are displayed will clear the display and return the panel to Parameter Mode, Parameter 99.10. Either STANDARD, REDUCED or ID MAGN will be displayed according to whether the ID Run is in progress or not. If no keys are pressed within 60 seconds and the ID Run is still in progress, the warning message is restored.

Actual signal no. 1.16 IDENTIF RUN DONE will be set True when the ID Run has been completed OK.

NOTE: Any change of the motor data parameters 99.5 ... 99.9 after a completed ID Run will delete the ID Run performed. A new ID Run (or First start) has to be performed without load before being able to operate the drive again.

11 DEVICE NAME This parameter can be used to set a name, e.g. Main Hoist, on the drive. The parameter can only be set using DriveWindow PC tool (it is not possible to enter text from the CDP312R panel). The name will appear on the DriveWindow configuration picture, and also on the CDP312R panel if pressing DRIVE key.

Chapter 4 - Control Operation

4.1 Overview

This chapter describes the Actual Signals, the Fault History and explains Keypad and External control.

***Note*:** The ACS800 is a speed controlled device. If you need to change frequency to speed use the following formula:

$$\text{SPEED (rpm)} = \frac{\text{FREQUENCY (Hz)}}{\text{NUMBER OF POLES}} * 120$$

Pole pairs = 1, 2, 3,..
Number of poles = 2, 4, 6,...

4.2 Actual Signals

Actual Signals monitor CraneDrive functions. They do not affect the performance of the CraneDrive. Actual Signal values are measured or calculated by the drive and they cannot be set by the user

The Actual Signal Display Mode of the Control Panel continuously displays three actual signals. When the ACT key is pressed, the full name of the three Actual Signals will be displayed. When the key is released, the short name (8 characters) and the value are displayed.

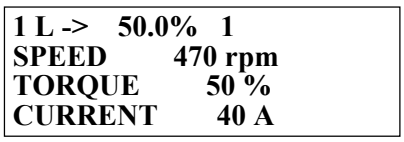


Figure 4-1 Actual Signal Display Mode.

Table 4-1 on the next page lists the Actual Signals: selected or monitored values, and functions.

To select the actual values to be displayed follow the procedure described in *Chapter 2 - Overview of CraneDrive Programming*, Table 2-3, page 2-6.

Table 4-1 Group 1, Actual Signal

Actual Signal (Group 1)	***Short name***	***Range/Unit***	***Description***
1 SPEED ESTIMATED	SP ESTIM	rpm	The estimated motor speed value, in rpm.
2 MOTOR SPEED FILT	SPEED	rpm	Filtered motor speed value, in rpm.
3 FREQUENCY	FREQ	Hz	Frequency to motor
4 MOTOR CURRENT	CURRENT	A	Motor current
5 MOTOR TORQUE FILT	TORQUE	%	Calculated motor torque. 100 is the motor nominal torque rating.
6 POWER	POWER	%	Motor power. 100 is the nominal power rating.
7 DC BUS VOLTAGE V	DC BUS V	V	Intermediate circuit voltage displayed in V_{DC}.
8 MAINS VOLTAGE	MAINS V	V	Calculated supply voltage at power on.
9 OUTPUT VOLTAGE	OUT VOLT	V	Calculated motor voltage.
10 ACS 800 TEMP	ACS TEMP	C (deg Celcius)	Temperature of the heatsink.
11 APPLICATION MACRO	MACRO	CRANE; M/F CTRL; USER 1 LOAD; USER 2 LOAD	
12 SPEED REF	SPEED REF	Rpm	Speed reference before ramp.
13 CTRL LOCATION	CTRL LOC	LOCAL; I/O CTRL; FIELDBUS; M/F CTRL	Active control location.
14 OP HOUR COUNTER	OP HOURS	h (Hours)	Elapsed power-on time meter.
15 KILOWATT HOURS	kW HOURS	kWh	kWh meter.
16 IDENTIF RUN DONE	ID RUN	True; False	Motor ID Run is done.
17 DI7-1 STATUS	DI7-1		Status of RMIO digital inputs.
18 AI1 (V)	AI1 (V)	V	Value of RMIO analogue input 1.
19 AI2 (mA)	AI2 (mA)	mA	Value of RMIO analogue input 2.
20 EXT AI1 (V)	EXT AI1	V	Value of RAIO-01 input 1.
21 RO3-1 STATUS	RO3-1		Status of RMIO relay outputs.
22 AO1 (mA)	AO1 (mA)	mA	Value of RMIO analogue output 1.
23 AO2 (mA)	AO2 (mA)	mA	Value of RMIO analogue output 2.
24 INERTIA	INERTIA	kgm^2	Calculated inertia from power optimisation autotune
25 EXT DI6-1 STATUS	EX DI6-1		Status of RDIO digital inputs.
26 EXT RO4-1 STATUS	EX RO4-1		Status of RDIO digital outputs.
27 MOTOR RUN-TIME	RUN-TIME	H (hours)	Elapsed motor run-time meter.
28 MOTOR TEMP EST	MOT TEMP	C (deg Celcius)	Estimated motor temperature.
29 CTRL BOARD TEMP	CTRL B T	C (deg Celcius)	Temperature of RMIO board.

Actual Signal (Group 1)	***Short name***	***Range/Unit***	***Description***
30 FAN ON TIME	FAN TIME	H (Hours)	Accumulated fan operating hours.
31 AI3 (mA)	AI3 (mA)	mA	Value of RMIO analogue input 3.
32 TOTAL OPER TIME	TOTAL OP	hrs (hours)	Elapsed run-time with brake open
33 LOAD TORQUE ton	LOAD ton	ton	The calculated hoist load in tons.
34 LOAD SPEC FACT Km	FACT Km		Load spectrum factor Km.
35 LIFETIME LEFT %	LIFETIME	%	Crane lifetime left %

4.3 Signal Selection - Description of the Actual Signals, Groups 1 and 2

1 SPEED ESTIMATED	Displays the estimated speed of the motor, as calculated by the CraneDrive (shows estimated speed also if encoder is enabled). The speed is displayed in rpm.
2 MOTSPEED FILT	Displays a filtered value of the actual speed of the motor, as calculated or measured by the CraneDrive.The speed is displayed in rpm.
3 FREQUENCY	Displays the CraneDrive frequency (Hz) applied to the motor, as calculated by the CraneDrive.
4 CURRENT	Displays the motor current, as measured by the CraneDrive.
5 MOTOR TORQUE	Displays the motor torque in per cent of the rated motor torque, as calculated by the CraneDrive.
6 POWER	Displays the motor power in per cent of the rated motor power.
7 DC BUS VOLTAGE V	Displays the DC bus voltage, as measured in the CraneDrive. The voltage is displayed in Volts DC.
8 MAINS VOLTAGE	Displays the mains voltage, as calculated by the CraneDrive. The voltage is displayed in Volts. NOTE: Calculation only done at power on.
9 OUTPUT VOLTAGE	Displays the motor voltage, as calculated by the CraneDrive.
10 ACS 800 TEMP	Displays the temperature of the heatsink in degrees centigrade.
11 APPLICATION MACRO	Indicates application or user macro selected (=parameter 99.2).
12 SPEED REF	Displays the value of the total speed reference before ramp in %. 100 % corresponds to SPEED SCALING RPM, parameter 69.1.
13 CTRL LOCATION	Displays the active control location. Alternatives are: LOCAL, I/O CTRL, FIELDBUS and M/F CTRL. Refer to Keypad vs. External Control in this chapter.
14 OP HOUR COUNTER	This Actual Signal is an elapsed-time indicator. It counts the time that the RMIO board has been powered. The counted time cannot be reset.
15 KILOWATT HOURS	This Actual Signal counts the kilowatt hours of CraneDrive in operation.
16 IDENTIFICATION RUN DONE	This signal indicates if the motor ID Run is completed OK.
17 DI7-1 STATUS	Status of the RMIO digital inputs DI1-6 + DI_IL (DI_IL here called “DI7”). If the input is connected to +24 VDC, the display will indicate 1. If the input is not connected, the display will be 0. Example: 1000010 = DI_IL is on, DI6 to DI3 is off, DI2 is on and DI1 is off.
18 AI1 (V)	Value of RMIO analogue input 1 displayed in volts.
19 AI2 (mA)	Value of RMIO analogue input 2 displayed in milliamperes.

20 EXT AI1 (V)	Value of RAIO-01 analogue input 1 displayed in volts.
21 RO3-1 STATUS	Status of the RMIO three relay outputs. 1 indicates that the relay is energised and 0 indicates that the relay is de-energised.
22 AO1 (mA)	Value of RMIO analogue output 1 signal in milliamperes.
23 AO2 (mA)	Value of RMIO analogue output 2 signal in milliamperes.
24 INERTIA	This actual signal is giving the calculated inertia value from running the Power Optimisation Autotune and has to be set in parameter 68.4 INERTIA TOTAL UP and 68.5 INERTIA TOTAL DWN.
25 EXT DI6-1 STATUS	Status of the six (3+3) RDIO digital inputs. If the input is connected to voltage, the display will indicate 1. If the input is not connected, the display will be 0.
26 EXT RO4-1 STATUS	Status of the four (2+2) RDIO relay outputs. 1 indicates that the relay is energised and 0 indicates that the relay is de-energised.
27 MOTOR RUN-TIME	This signal is an elapsed motor run-time meter. It counts the time, in hours, that the motor has been running with current. The counted time can be reset with parameter 97.10 RESET MOTOR RUNTIME.
28 MOTOR TEMP EST	This signal is displaying the estimated motor temperature in degrees Centigrade. Note: The estimated motor temperature calculation starts at 30 deg C after a RMIO power on (init).
29 CTRL BOARD TEMP	This signal is displaying the measured temperature on the RMIO board in degrees Centigrade.
30 FAN ON TIME	This signal is displaying the accumulated operating hours for the cooling fan. NOTE: Using DriveWindow tool, this signals value can be reset to zero if replacing fan unit. If replacing the RMIO board, please restore (copy) the value for this signal from old to new board (read value before replacing board).
31 AI3 (mA)	Value of RMIO analogue input 3 displayed in milliamperes. See description of parameter 20.10 for details.
32 TOTAL OPER TIME	Total operating time of drive, in hours, with brake open. Backed up in non-volatile memory.
33 LOAD TORQUE ton	Load torque signal scaled in ton using parameters 68.12-13 & 74.1
34 LOAD SPEC FACT Km	Load spectrum factor Km (value between 0.0 and 1.0) is the degree of utilization over the lifetime for the hoist mechanics. Calculated by the Crane lifetime monitor function (par. group 74).
35 LIFETIME LEFT %	The calculated mechanical lifetime left of hoist. In percent of lifetime set in parameter 74.2

Table 4-2 Group 2, Internal Signals

INT SIGNALS (Group 2)	***Range/Unit***	***Description***
1 SPEED REF 2	rpm	Ramp input reference limited by speed limits (parameters 20.1 & 20.2)
2 SPEED REF 3	rpm	Ramp output reference
3 SPEED REF 4	rpm	Total speed reference = ramp output reference + speed correction reference
4 SPEED ERROR NEG	rpm	Actual speed - total speed reference
5 TORQUE PROP REF	%	Speed controller proportional part output
6 TORQUE INTEG REF	%	Speed controller integration part output
7 TORQUE DER REF	%	Speed controller derivative part output
8 TORQ ACC COMP REF	%	Acceleration compensation reference
9 TORQUE REF 1	%	Torque reference input to drive (torque ramp output)
10 TORQUE REF 2	%	Speed controller total output + acceleration compensation reference. Limited with parameters 20.4 & 20.5
11 TORQUE REF 3	%	Output of “Torque Selector”, see parameter 72.2
12 TORQUE REF 4	%	Torque ref 3 + Load compensation
13 TORQUE REF 5	%	Torque ref 4 + Torque step
14 TORQ USED REF	%	Final torque reference used by torque controller (Torque ref 5 with limits)
15 MOTOR TORQUE	%	Actual motor torque
16 FLUX ACT	%	Actual motor flux
17 SPEED MEASURED	rpm	Measured (RTAC) motor speed
18 POS ACT PPU	+/- 32767	Position measurement value (scaled with par. 70.1)
19 START	True; False	Start-order given
20 RUNNING	True; False	Drive running (producing torque) acknowledgment
21 BRAKE LIFT	True; False	Brake lift order
22 FAULT	True; False	Drive fault indication (tripped)
24 SPEED CORR	rpm	Speed correction reference
25 POWOP SPEEDREF	%	Power optimisation calculated speed reference
26 ELSHAFT POS ERROR		Electric shaft control position error in Slave drive
27 LIMIT WORD 1	0 – FFFF Packed boolean (Hex)	Limit word indicating if drive is running in any limitation, For bit details see table 4-3 below
28 FAULTED INT INFO	0 – FFFF Packed boolean (Hex)	INT board fault info, For bit details see table 4-4 below
29 TORQUE SELECTOR	0 – 5	Torque reference (2.11) mode active: 0 = Zero control (=speed control in CraneDrive) 1 = Speed control (Torq ref 2) 2 = Torque control (Torq ref 1) 3 = Minimum control (min of Torq ref 1 and 2) 4 = Maximum control (max of Torq ref 1 and 2) 5 = Add control (sum of Torq ref 1 and 2)
30 dV/dt	rpm/s	Derivative of speed reference ramp output, Speed ref3. That is, rate of change (with sign) in rpm per sec
31 LOAD TORQUE %	%	Calculated load torque in % of motor nominal torque. Signal is filtered with parameter 68.10 .
32 LIMIT WORD INV	0 – FFFF (Hex)	Indicating details if 2.27 bit 4 Torq_inv_cur_lim is set. See table 4-5 below for details.
33 INT SC INFO	0 – FFFF (Hex)	Info on short circuit location. See table 4-6 below.

*Table 4-3 Signal **2.27 LIMIT WORD 1***

Bit	Name	Active Limit
0	TORQ MOTOR LIM	Motor pull-out torque limit reached.
1	SPD_TOR_MIN_LIM	Speed control torque min. limit
2	SPD_TOR_MAX_LIM	Speed control torque max. limit.
3	TORQ_USER_CUR_LIM	User-defined current limit
4	TORQ_INV_CUR_LIM	Internal current limit.
5	TORQ_MIN_LIM	Any torque min. limit.
6	TORQ_MAX_LIM	Any torque max. limit
7	TREF_TORQ_MIN_LIM	Torque reference min. limit.
8	TREF_TORQ_MAX_LIM	Torque reference max. limit.
9	FLUX_MIN_LIM	Flux reference min. limit
10	FREQ_MIN_LIMIT	Speed/Frequency min. limit.
11	FREQ_MAX_LIMIT	Speed/Frequency max. limit
12	DC_UNDERVOLT	DC undervoltage limit.
13	DC_OVERVOLT	DC overvoltage limit.
14	TORQUE LIMIT	Any torque limit.
15	FREQ_LIMIT	Any speed/frequency limit.

Note: Bit 4 TORQ_INV_CUR_LIM is activated if thermal overload from inverter or braking chopper is detected. See details in 2.32 LIMIT WORD INV

*Table 4-4 Signal **2.28 FAULTED INT INFO**.*
This word includes information on the location of faults: PPCC LINK, OVERCURRENT, EARTH FAULT, SHORT CIRCUIT, ACS800 TEMP, TEMP DIF and POWERF INT.

Bit	Name	Description
0	INT 1 FLT	INT 1 board fault (R8i module #1)
1	INT 2 FLT	INT 2 board fault * (R8i module #2)
2	INT 3 FLT	INT 3 board fault * (R8i module #3)
3	INT 4 FLT	INT 4 board fault * (R8i module #4) a.s.o.
4	INT 5 FLT	INT 5 board fault *
5	INT 6 FLT	INT 6 board fault *
6	INT 7 FLT	INT 7 board fault *
7	INT 8 FLT	INT 8 board fault *
8	INT 9 FLT	INT 9 board fault *
9	INT 10 FLT	INT 10 board fault *
10	INT 11 FLT	INT 11 board fault *
11	INT 12 FLT	INT 12 board fault *
12…14	Not in use	
15	PBU FLT	PBU board fault

* In use only with parallel inverters. INT 1 is connected to PBU CH1, INT 2 to CH2 a.s.o.

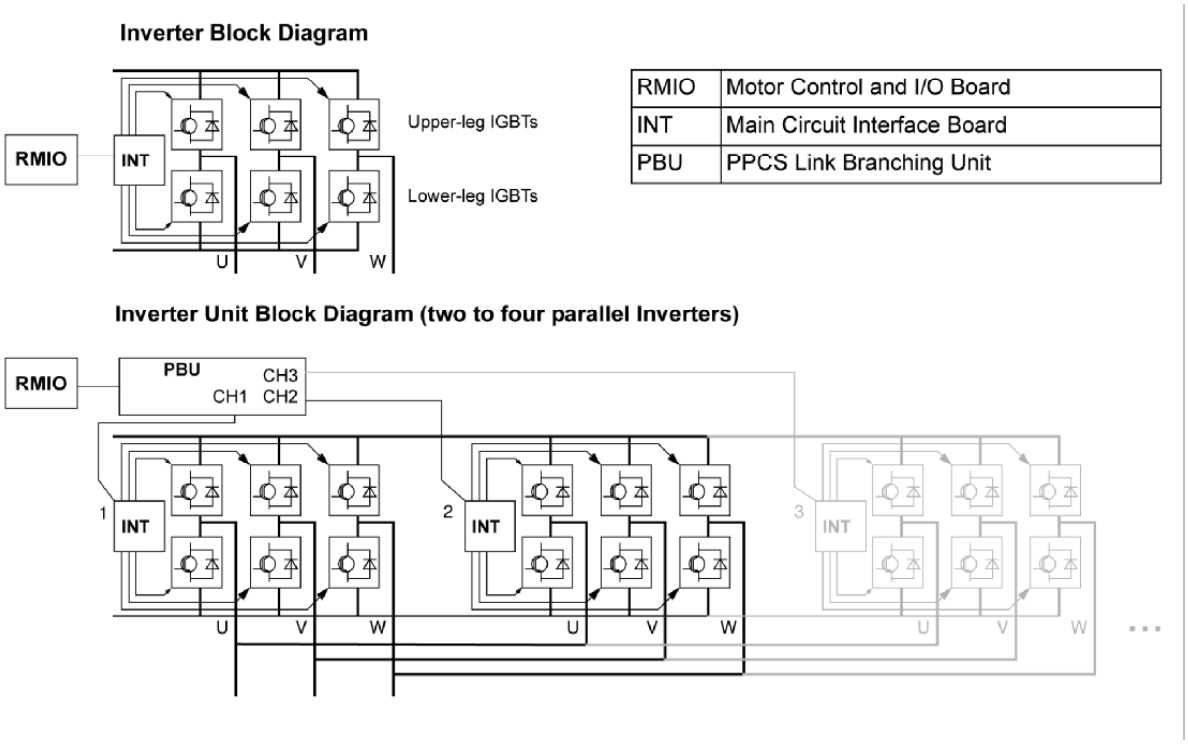
*Table 4-5 Signal **2.32 LIMIT WORD INV**.*
This word gives more detailed information when the TORQ INV CUR LIM (bit 4 in 2.27 LIMIT WORD 1) is active, indicating that output current limit of the drive is exceeded. The current limitation protects the drive in various cases, e.g. integrator overload, high IGBT temperature etc.

Bit	Name	Description
0	INTEGRAT 200	Current limit at 200% integrator overload. * Temperature model is not active.
1	INTEGRAT 150	Current limit at 150% integrator overload. * Temperature model is not active.
2	INT LOW FREQ	Current limit at high IGBT temperature with low output frequency (<10 Hz). * Temperature model is not active.
3	INTG PP TEMP	Current limit at high IGBT temperature. * Temperature model is not active.
4	PP OVER TEMP	Current limit at high IGBT temperature. Temperature model is active.
5	PP OVERLOAD	Current limit at high IGBT junction to case temperature. Temperature model is active. If the IGBT junction to case temperature continues to rise in spite of the current limitation, PP OVERLOAD alarm or fault occurs.
6	INV POW LIM	Current limit at inverter output power limit (at chopper power limit if during braking with chopper).
7	INV TRIP CUR	Current limit at inverter overcurrent trip limit
8	OVERLOAD CUR	At maximum inverter current limit I_{max}. See par. 20.03 .
9	CONT DC CUR	Continuous dc-current limit.
10	CONT OUT CUR	Continuous output current limit ($I_{cont.max}$).
11…15	Not in use	

* Only active with ACS600 type inverters (with NINT board)

*Table 4-6 Signal **2.33 INT SC INFO***
This word includes info on the location of the SHORT CIRCUIT fault

Bit	Name	Description
0	U-PH SC U	Phase U upper-leg IGBT(s) short circuit
1	U-PH SC L	Phase U lower-leg IGBT(s) short circuit
2	V-PH SC U	Phase V upper-leg IGBT(s) short circuit
3	V-PH SC L	Phase V lower-leg IGBT(s) short circuit
4	W-PH SC U	Phase W upper-leg IGBT(s) short circuit
5	W-PH SC L	Phase W lower-leg IGBT(s) short circuit
6…15	Not in use	



Note: For information on Group 3 (FB REC WORDS) and Group 4 (FB TRA WORDS) signals, see Appendix A.

4.4 Fault History

The Fault History includes information on the fifteen most recent faults and warnings that occurred in the CraneDrive. The description of the fault and the total power-on time are available. The power-on time is calculated always when the RMIO board of the CraneDrive is powered.

Chapter 2 - Overview of CraneDrive Programming, Table 2-4, page 2-7, describes how to display and clear the Fault History from the Control Panel.

4.5 Local Control vs. External Control

The CraneDrive can be controlled (i.e. reference, ON/OFF and Start commands can be given) from an external control location or from Local control (Control Panel Keypad or a DrivesWindow PC tool). Figure 4-2 below shows the CraneDrive control locations.

The selection between Keypad control and External control can be done with the LOC REM key on the Control Panel keypad.

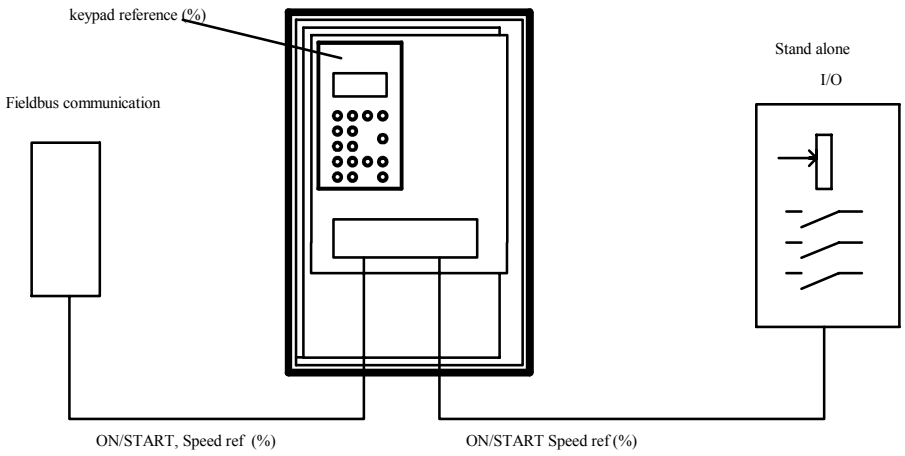


Figure 4-2 Control Locations

If the device controlling the CraneDrive stops communicating, the operation defined by Parameter 30.12 MASTER FAULT FUNC, or 30.2 PANEL LOSS is executed.

4.5.1 Keypad Control

The control commands are given from the Control Panel keypad when CraneDrive is in Keypad Control. This is indicated by L (Local) on the Control Panel display.

0 L 52.3 %

If operational commands and reference cannot be given from this Control Panel, it displays a blank character as shown below.

71.□ 52.3 %

***Note*:** All references are always given in % of SPEED SCALING RPM (Parameter 69.1)

4.5.2 External Control

When the CraneDrive is in External Control, the commands are given either from Fieldbus or I/O (Stand Alone mode). Selection is done with parameter 64.1 Stand Alone Sel.

Stand alone

If par. Stand Alone Sel (parameter 64.1) is set True (default value) the Stand Alone mode is selected.

In external control the digital inputs DI 1 - DI 6 and Ext DI1 – DI4 as well as analog inputs AI1 & AI2 wired directly from joystick and limit switches, are connected to a CRANE function module (except in FB JOYSTICK control mode where joystick signals are sent via fieldbus to CRANE function module, see end of section 5.6.5 for details).

.

The CRANE function module is producing the references and commands like ON/OFF, START and so on.

Fieldbus

When the CraneDrive is in Fieldbus mode (64.1 Stand Alone Sel=False) the commands are given from the supervisory system and received over the fieldbus communication link (see section 5.6..

4.6 Control Signals Connection Stand Alone mode

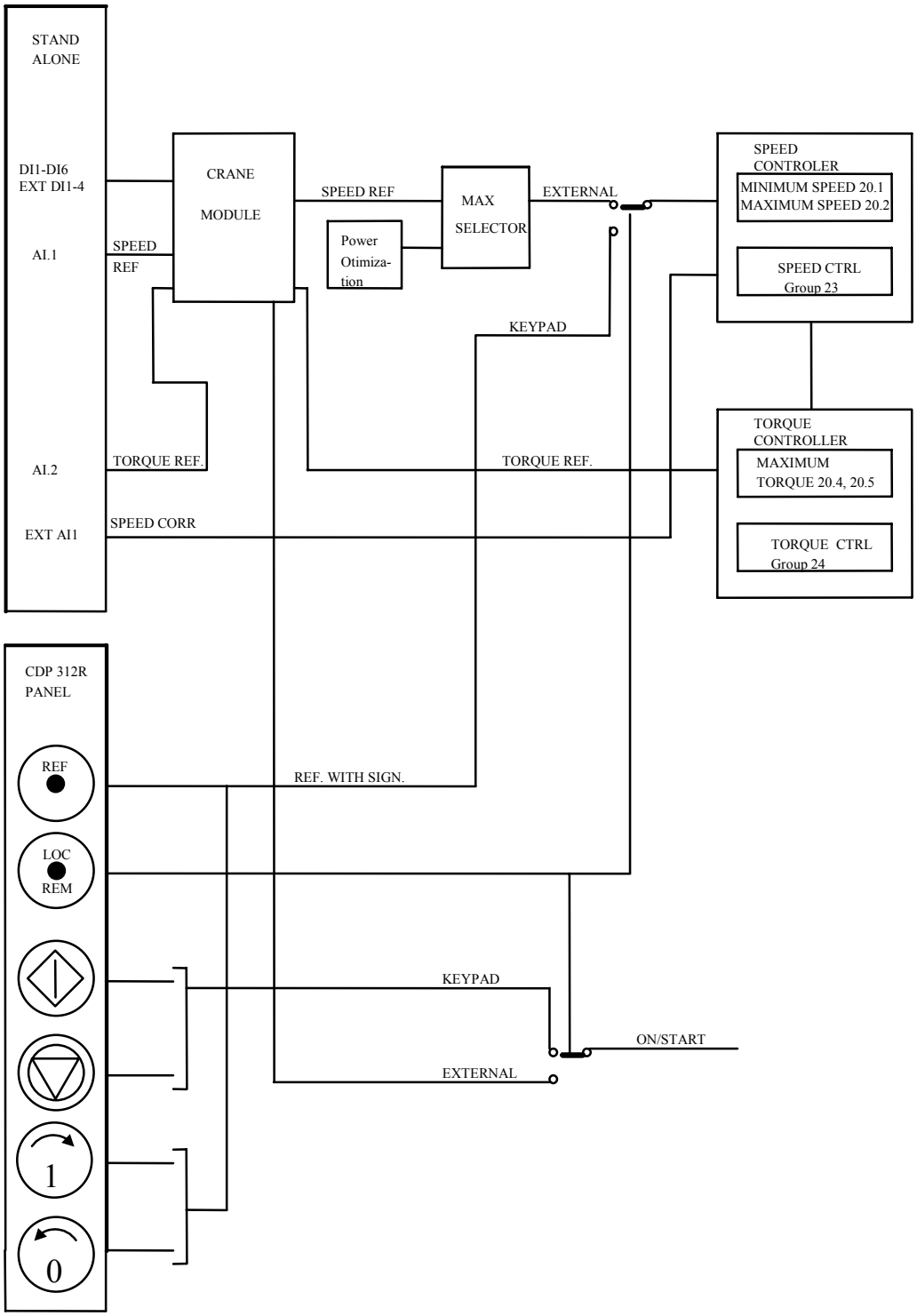


Figure 4-3 Selecting control location and control source

4.7 Control Signals Connection in Fieldbus mode

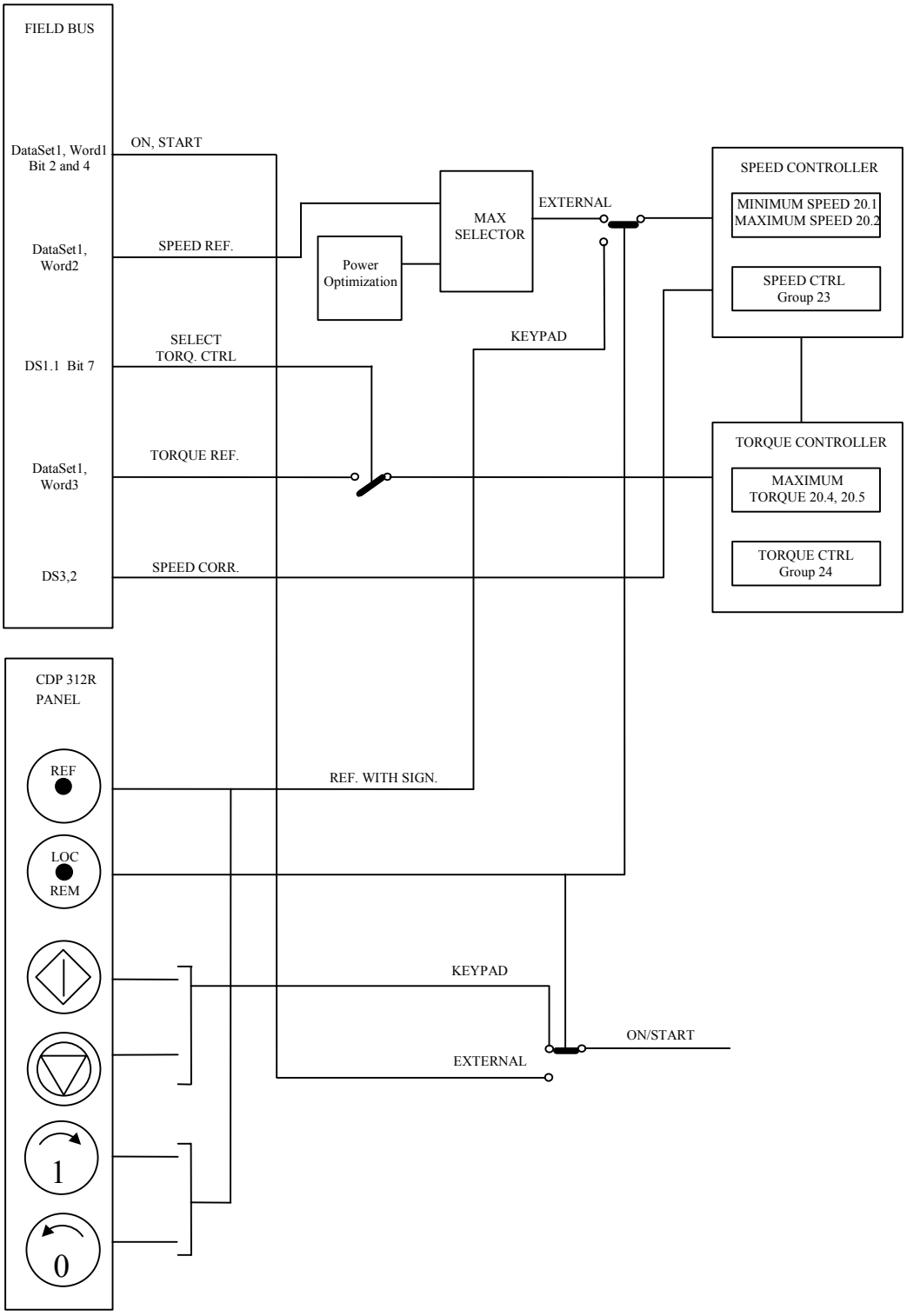


Figure 4-4 Selecting control location and control source.

4.8 External 24V supply of RMIO board

To keep the control panel and the RMIO board active when the mains supply is switched off, a separate 24 Vdc supply can be connected. See ACS 800 Hardware manual for details.

4.8.1 Power On Acknowledge input signal

If the CraneDrive is equipped with an external 24 V supply to RMIO board, it is recommended to connect a NO (Normally Open) auxiliary contact of AC power contactor to digital input for signal “Power On Ackn”, e.g. DI2. Input is selected with parameter 10.5. Drive is automatically reset at power on using the Power On Ackn input signal. Also a proper masking of Chopper fault and PPCC Link fault during power off, is achieved using the Power On Ackn signal.
A “0” on Power On Ackn input will generate an “Off” command of the CraneDrive, that is: coast stop plus closing of mechanical brake.
No operation of CraneDrive is possible if Power On Ackn input is “0”!

NOTE: If using ACS 800 Multidrive, parameter 10.5 POWER ON ACKN SEL should be set = DI2 !.

Chapter 5 - Crane Program Description

5.1 Overview

This chapter describes the functionality of the Crane program with its two Application Macros: CRANE and M/F CTRL, and the two external control modes: Field bus mode and Stand Alone mode.
The chapter also describes how to use the two User Macros.

The chapter contains the following information:
- Application Macro information
- Operation, Fieldbus and Stand alone mode
- External I/O Connections
- Parameter Settings
- Functional Block diagram of program
- Function module descriptions

The Parameter Settings tables in this chapter indicate parameters you may have to modify. These parameters are indicated in the tables with an arrow (-->) symbol.

Refer to Appendix A – Complete Parameter Settings for the alternative settings for each parameter.

5.2 Application Macros

There are two application macros: **CRANE** and **M/F CTRL.**
Selection is done with parameter 99.2 Application macro.
Default setting is CRANE macro.

CRANE macro includes all the crane software functions except the Master/Follower bus functionality.

M/F CTRL macro includes all functions of the CRANE macro **plus** Master/Follower bus functionality (see description of function module “Master/Follower (72)”).

NOTE: A change of application macro will reset all parameter settings to default, except for parameter group 99 and motor ID Run data stored. Therefore macro selection should be done before making the application parameter settings.

5.3 Speed Reference chain

Material to be issued later.

5.4 Stand alone mode operation

All drive commands and reference settings can be given from the Control Panel keypad or selectively from an external control location.

The active control location is selected with the **LOC REM** key on the Control Panel keypad. The drive is speed controlled.

In External Control the control location is the basic I/O. The reference signal is connected to analogue input AI1 and On/Start and Direction signals are generated from digital inputs DI2 ... DI4 on terminal block X21.

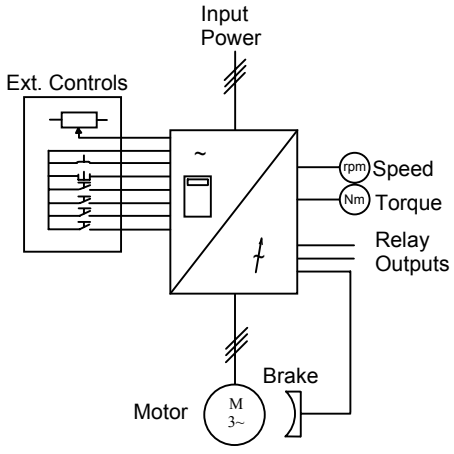
DI5 is used for connecting slowdown limit switches in series, and DI6 for Fast Stop order from mechanical overload and slack rope indications.

The mechanical brake is controlled from DO1 and the acknowledgement is connected to DI1.

Two analogue and three relay output signals are available on terminal blocks. Default signals for the Actual Signal Display Mode of the Control Panel are SPEED, TORQUE and CURRENT.

The feedback data through Fieldbus communication: drive -> PLC is available also in stand alone mode (by enabling Comm module; parameter 98.2).

Operation Diagram




```
1 L ->   50.0%   1
SPEED      470 rpm
TORQUE      50 %
CURRENT     40 A
```

Reference and Start/Stop and Direction commands are given from the Control Panel. To change to External ctrl, press **LOC REM** key at standstill.

```
1        50.0%   1
SPEED      470 rpm
TORQUE      50 %
CURRENT     40 A
```

Speed reference is read from analogue input AI1 (Terminal Block X21). On/Start and Direction commands are generated from digital inputs DI2, DI3 and DI4.

Figure 5-1 Operation Diagram for Stand Alone Mode.

5.4.1 Input and Output I/O Signals

Input and Output I/O Signals as default ("Joystick" control type) assigned by the Crane program. (For more details see Crane module (64) description in section 5.6.5)

Input Signals	*Output Signals*
Brake Ackn: (DI1)	Analogue Output AO1: Speed
Zero Pos: (DI2)	Analogue Output AO2: Torque
Start Dir A: (DI3)	Relay Output RO1: Brake lift
Start Dir B: (DI4)	Relay Output RO2: Watch dog-N
Slow Down-N: (DI5)	Relay Output RO3: Fault-N
Fast Stop-N: (DI6)	
Speed Ref: (AI1)	
Torque Ref: (AI2)	
Speed Corr: (Ext AI1)	

5.4.2 External Connections

The following connection example is applicable when the Crane program with Stand Alone control mode and Joystick control is used.

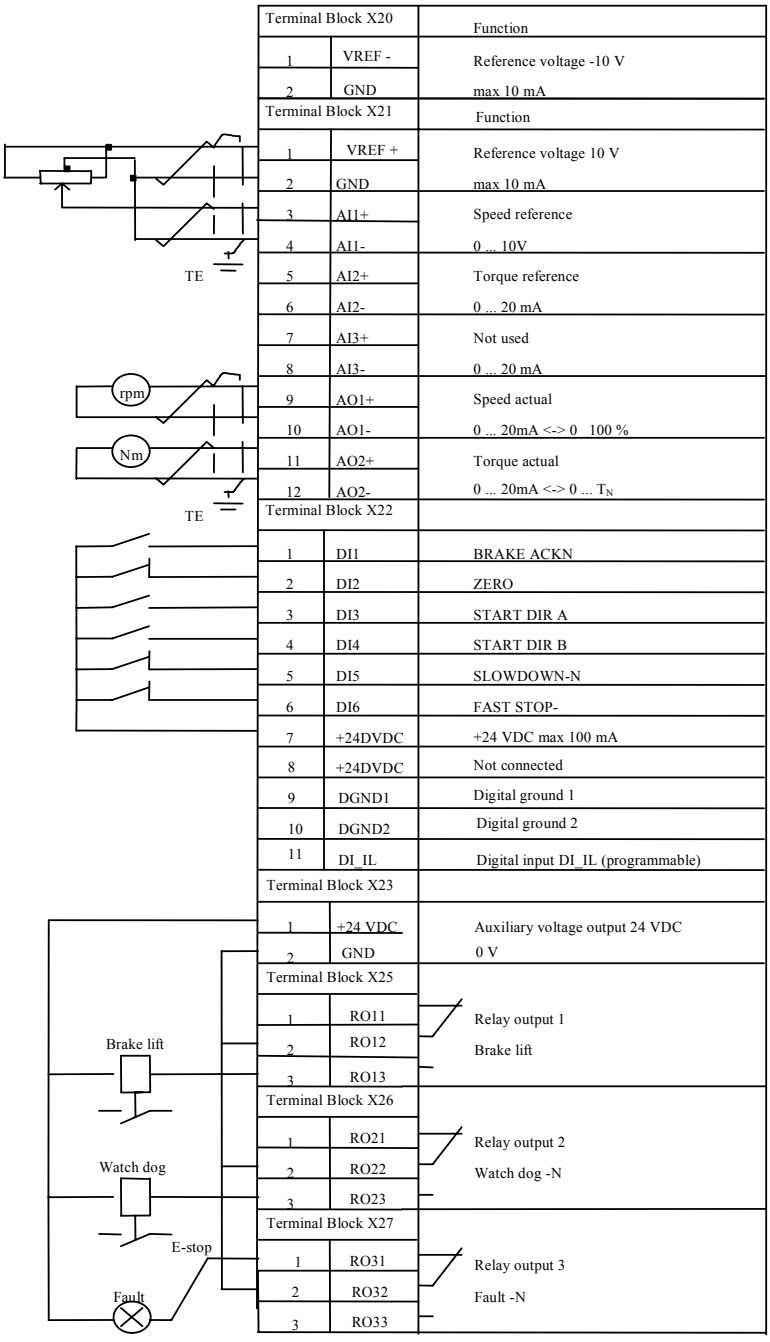


Figure 5-2 External connections to RMIO board in Stand Alone mode, Joystick control.

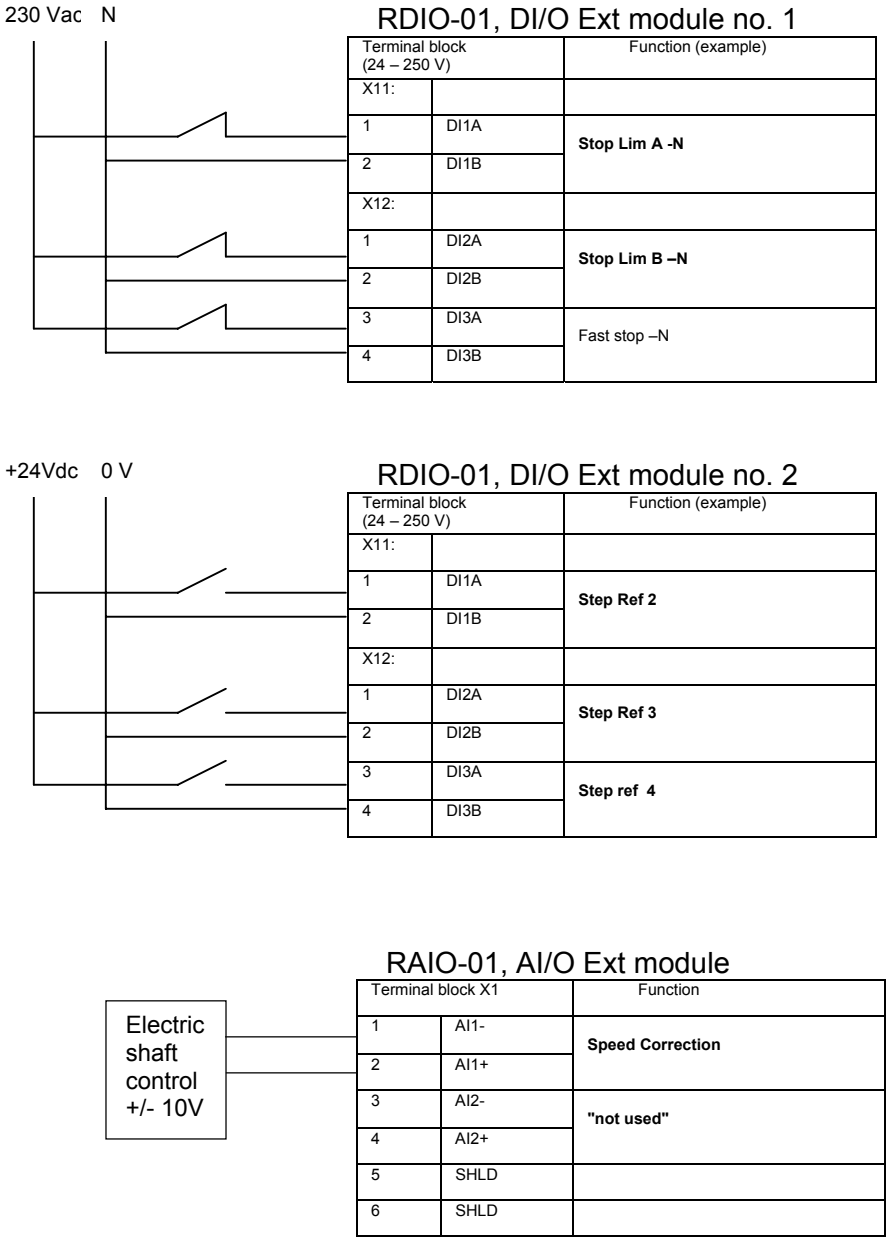


Figure 5-3 External connections to extended I/O modules RDIO-01 and RAIO-01, in Stand Alone mode, Step joystick control.

5.4.3 Control Signals Connection Stand Alone mode

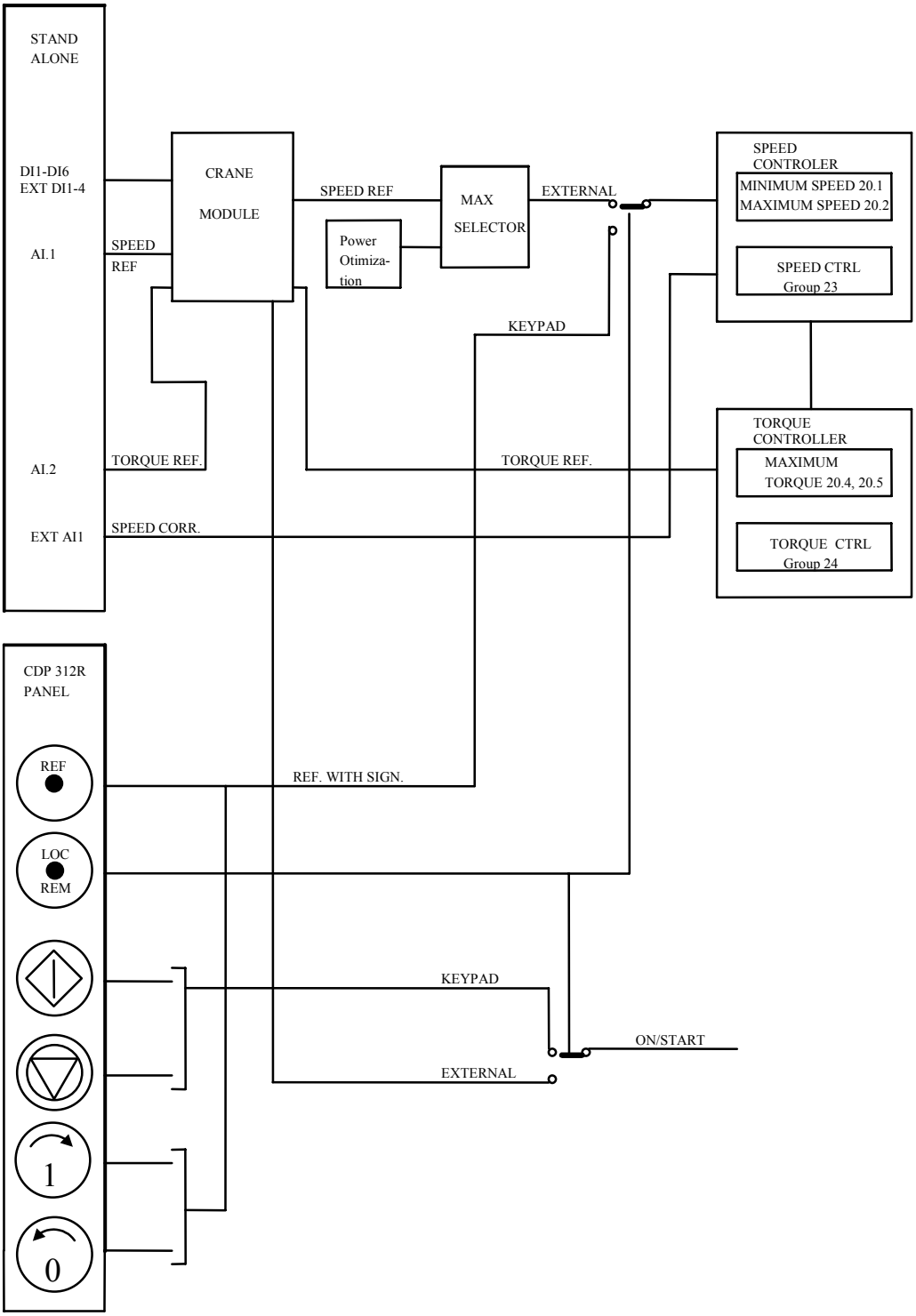


Figure 5-4 Control Signals Connection Stand Alone mode

5.4.4 Parameter Settings for the Stand alone mode

Table 5-1 Listing of parameters typically requiring changes during start-up. Stand alone mode.

99 START-UP DATA		
99.2 APPLICATION MACRO		CRANE
99.3 APPLIC RESTORE		NO
99.4 MOTOR CTRL MODE	→	DTC
99.5 MOT NOM VOLTAGE	→	0 V
99.6 MOTOR NOM CURRENT	→	0.0 A
99.7 MOTOR NOM FREQ	→	50.0 Hz
99.8 MOTOR NOM SPEED	→	1 rpm
99.9 MOTOR NOM POWER	→	0.0 kW
99.10 MOTOR ID RUN	→	ID MAGN
99.11 DEVICE NAME	→	
10 DIGITAL INPUTS		
10.1 BRAKE ACKN SEL		DI1
10.2 ZERO POS SEL	→	DI2
10.3 SLOWDOWN-N SEL	→	DI5
10.4 FAST STOP-N SEL	→	DI6
10.5 POWER ON ACKN SEL	→	NOT USED
10.6 SYNC SEL		NOT USED
10.7 CHOPPER FLT-N SEL	→	NOT USED
10.8 STEP REF2 SEL		NOT USED
10.9 STEP REF3 SEL		NOT USED
10.10 STEP REF4 SEL		NOT USED
10.11 HIGH SPEED SEL		NOT USED
10.12 SNAG LOAD-N SEL		NOT USED
10.13 ACCELERATE SEL		NOT USED
10.14 FB STOPLIM SEL		NOT USED
10.15 ELSHAFT ON SEL		NOT USED
20 LIMITS		
20.1 MINIMUM SPEED	→	(calculated)
20.2 MAXIMUM SPEED	→	(calculated)
20.3 MAXIMUM CURRENT A	→	200 % I_{hd} (A)
20.4 MAXIMUM TORQUE	→	200 %
20.5 MINIMUM TORQUE	→	-200 %
20.6 OVERVOLTAGE CTRL		OFF
20.7 UNDERVOLTAGE CTRL		ON
20.10 SPEED LIMIT AI3		100%
21 START/STOP		
21.1 START FUNCTION		CONST DC-MAGN
21.2 CONST MAGN TIME	→	500 ms
23 SPEED CTRL		
23.1 GAIN	→	10.0
23.2 INTEGRATION TIME	→	2.50 s
23.3 DERIVATION TIME		0.0 ms
23.4 ACC COMPENSATION		0.00 s
23.5 SLIP GAIN		100.0 %
23.6 AUTOTUNE RUN ?		NO
23.7 FEEDB FILTER TIME		4 ms
23.8 SPEED STEP		0.0 rpm
27 BRAKE CHOPPER		
27.1 BRAKE CHOPPER CTL	→	OFF (R2&R3=ON)
27.2 BR OVERLOAD FUNC	→	NO
27.3 BR RESISTANCE	→	100.00 ohm
27.4 BR THERM TCONST	→	0.000 s
27.5 MAX CONT BR POWER	→	0.00 kW
27.6 BC CTRL MODE		AS GENERATOR
50 PULSE-ENCODER (visible when 98.1 is activated)		
50.1 ENCODER PULSE NR	→	1024
50.2 SPEED MEAS MODE		A_-_B_-_
50.3 ENCODER ALM/FLT		FAULT
50.4 ENCODER DELAY		1000 ms

62 TORQUE MONITOR		
62.1 TORQ MON SEL		TRUE
62.2 SP DEV LEV		10 %
62.3 TORQ FLT TD		600 ms
62.4 SP DER BLK LEV	→	13 % /s *)
63 FAST STOP		
63.1 FAST STOP TYPE 11		NOT USED
63.2 FAST STOP TYPE 12	→	NOT USED
64 CRANE		
64.1 STAND ALONE SEL		TRUE
64.2 CONTIN GEAR		FALSE
64.3 HIGH SPEED LEVEL 1		98 %
64.4 DEADZONE A	→	0 %
64.5 DEADZONE B	→	0 %
64.6 REF SHAPE		20
64.7 SLOWDOWN SPEEDREF	→	25 %
64.8 ZERO POS OK TD		0.3 s
64.9 TORQUE REF SCALE		1.00
64.10 CONTROL TYPE	→	JOYSTICK
64.11 MINIMUM REF		0.0 %
64.12 JOYSTICK WARN TD		400 ms
64.13 STEP REF LEVEL 1		10 %
64.14 STEP REF LEVEL 2		25 %
64.15 STEP REF LEVEL 3		50 %
64.16 STEP REF LEVEL 4		100 %
66 TORQUE PROVING		
66.1 TORQ PROV SEL	→	FALSE
66.2 TORQ PROV FLT TD		0.5 s
66.3 TORQ PROV REF		20 %
68 POWER OPTIMIZATION		
68.1 POWOP SELECT	→	FALSE
68.2 BASE SPEED	→	100 %
68.3 POWOP AUTOTUNE SEL		FALSE
68.4 INERTIA TOTAL UP	→	3 KGM^2
68.5 INERTIA TOTAL DWN	→	30 KGM^2
68.6 TQLIM UP	→	100 %
68.7 TQLIM DWN	→	75 %
68.8 POWOP RESET LEV		12 %
68.9 T MAX	→	500 %
69 REFERENCE HANDLER		
69.1 SPEED SCALING RPM	→	1500 rpm
69.2 ACC TIME FORW	→	5.0 s
69.3 ACC TIME REV	→	5.0 s
69.4 DEC TIME FORW	→	5.0 s
69.5 DEC TIME REV	→	5.0 s
69.6 S-RAMP TC		0.0 s
69.7 RAMP SCALE LOCAL		2.0
69.10 RAMP RATE=1		TRUE
98 OPTION MODULES		
98.1 ENCODER MODULE	→	NO
98.2 COMM. MODULE		NO
98.3 CH3 NODE ADDR		1
98.4 CH0 NODE ADDR		1
98.5 DI/O EXT MODULE 1	→	NO
98.5 DI/O EXT MODULE 1	→	NO
98.7 AI/O EXT MODULE 1	→	NO

*) Calculate as: 100 / (RT x 1.5) %/s
where RT = longest ramp time in seconds

→ Typical parameter values to check during start-up. If required, alter the values to meet the needs of your application. A complete parameter list is provided in Appendix A.

5.5 Fieldbus mode operation

All drive commands and reference settings can be given from the Control Panel keypad or selectively from an external control location.

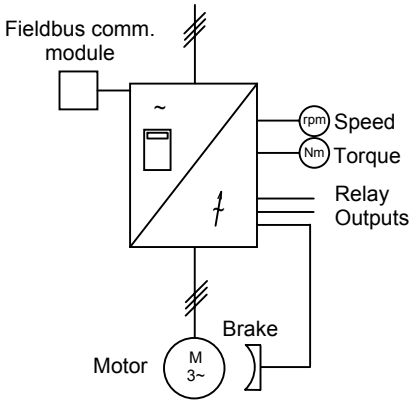
The active control location is selected with the **LOC REM** key on the Control Panel keypad. The drive is normally speed controlled.

In External Control the control location is from the Fieldbus communication. The reference signal, On/Start a.s.o. are connected to corresponding datasets, see Fieldbus Receive description for details.

The mechanical brake is controlled from DO1 and the acknowledgement is connected to DI1 as a default.
Example of digital input connections:
DI2 Power On Ackn, is connected to an auxiliary contact of the incoming power breaker. DI3 Sync, is position measurement synchronisation. DI4 Chopper Fault-N, is connected to the braking chopper fault contact.

Two analogue and three relay output signals are available on terminal blocks. Default signals for the Actual Signal Display Mode of the Control Panel are SPEED, TORQUE and CURRENT.

Operation Diagram




```
1 L ->   50.0%   1
SPEED        470 rpm
TORQUE        50 %
CURRENT       40 A
```

Reference and Start/Stop and Direction commands are given from the Control Panel. To change to External ctrl, press LOC REM key at standstill.

```
1        50.0%   1
SPEED        470 rpm
TORQUE        50 %
CURRENT       40 A
```

Start/Stop commands and References are received through the Fieldbus communication

Figure 5-5 Operation Diagram for Fieldbus Mode.

5.5.1 Input and Output I/O Signals

Example of Input and Output I/O Signals selected when Fieldbus mode is selected i.e. supervisory controller (PLC) is used:

Input Signals	*Output Signals*
Brake Ackn: (DI1)	Analogue Output AO1: Speed
Power On Ackn: (DI2)	Analogue Output AO2: Torque
Sync: (DI3)	Relay Output RO1: Brake lift
Chopper Flt-N: (DI4)	Relay Output RO2: Watchdog-N
	Relay Output RO3: Fault-N

5.5.2 External Connections

The following connection example is applicable when the Crane program is used in Fieldbus mode.

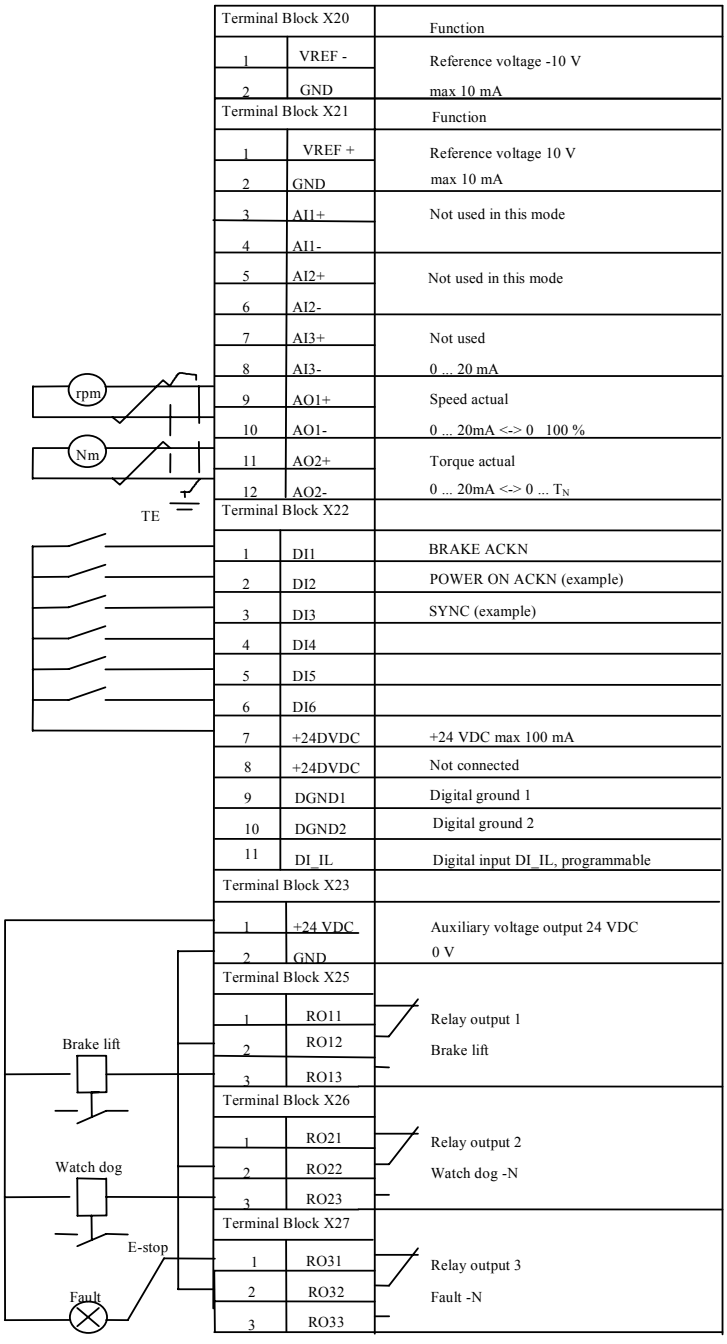


Figure 5-6 External connections in Fieldbus mode

5.5.3 Control Signals Connection in Field Bus mode

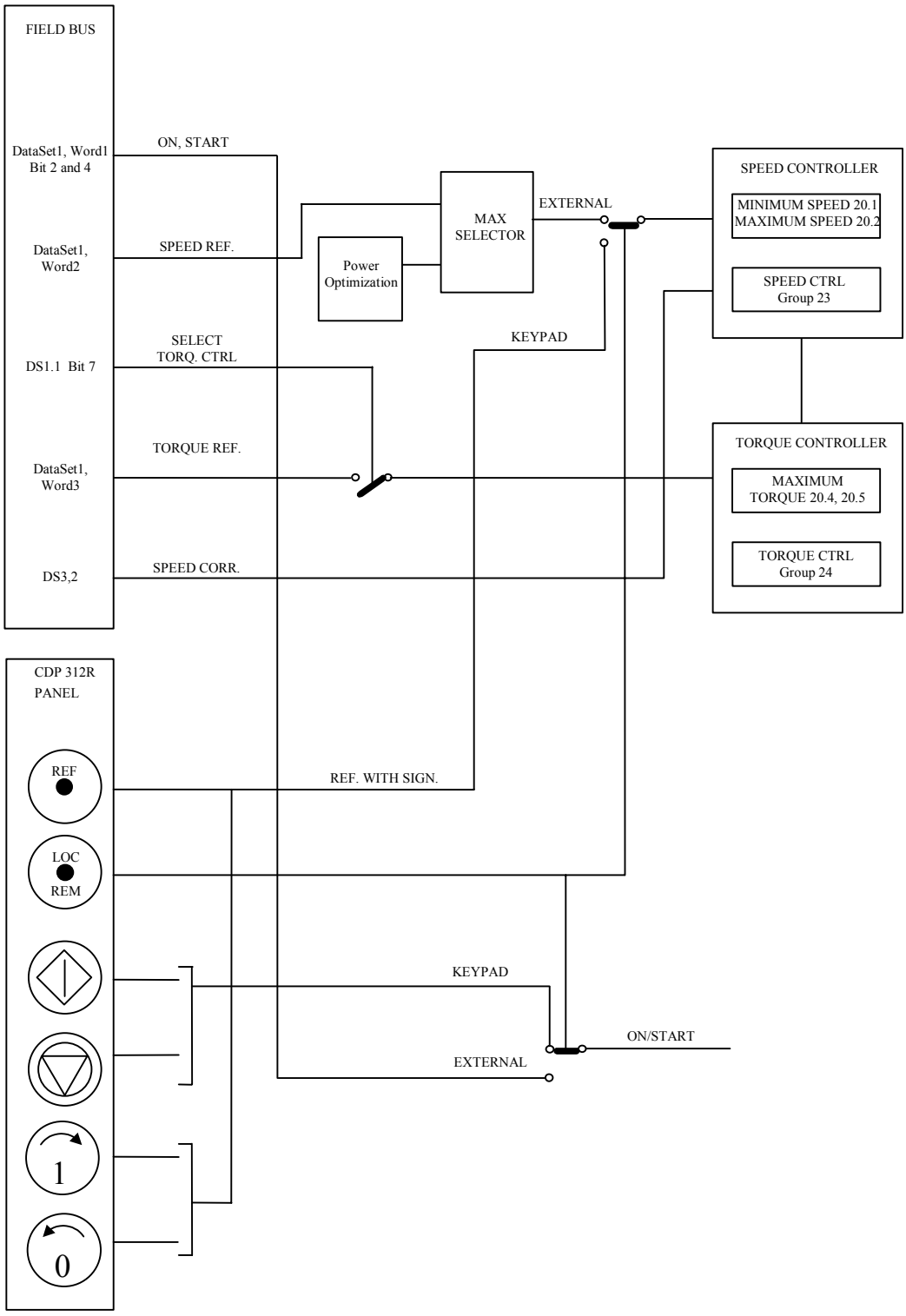


Figure 5–7 Control Signals Connection in Fieldbus mode

5.5.4 Speed correction in Fieldbus mode

In Fieldbus mode there is a possibility to send a speed correction reference (“non-ramped” reference added to ramp unit output), to the drive:

In the Fieldbus communication interface: DataSet 3, Word 2 is connected as a Speed Correction input signal (8 ms updating time in ACC 800 application software).

The speed correction reference is limited so that the sum of the normal “ramped” speed reference and the speed correction reference cannot exceed Maximum/Minimum Speed setting (parameters 20.1 & 20.2).

5.5.5 External Chopper monitoring (available in both Fieldbus and Standalone mode)

If using an external braking chopper, the braking chopper fault contact (use the “normally open” contact; closed contact when DC voltage is on and no fault), can be monitored by the drive if connected to a digital input (Parameter 10.7 Chopper Flt-N Sel). If open contact (“0”) to the digital input, the drive will trip and indicate CHOPPER FAULT to panel, faultlogger and Fieldbus faultword. Also the Watchdog signal (DO2) will indicate.

WARNING! If a braking chopper fault occurs, the incoming AC voltage to the drive must be disconnected! (This is the only way to stop the current in the braking resistor if the fault is a short circuit in the braking chopper) This is done by connecting the Watchdog-N output DO2 to the drive emergency stop circuit.

During power on of drive (Power On Ackn ,e.g. DI2, changing from “0” to “1”) the Chopper fault monitoring is blocked during the time Chopper Monit Td, parameter 71.3, to avoid false indications.
Parameter value must be kept as low as possible (approx. 1000 ms). This is to avoid burning out the charging resistor in the drive, if switching on power to the drive when there is a short circuit in the braking chopper.

5.5.6 Parameter Settings for the Fieldbus mode

Table 5-2 Listing of parameters typically requiring changes during start-up. Fieldbus mode.

99 START-UP DATA		
99.2 APPLICATION MACRO		CRANE
99.3 APPLIC RESTORE		NO
99.4 MOTOR CTRL MODE	→	DTC
99.5 MOT NOM VOLTAGE	→	0 V
99.6 MOTOR NOM CURRENT	→	0.0 A
99.7 MOTOR NOM FREQ	→	50.0 Hz
99.8 MOTOR NOM SPEED	→	1 rpm
99.9 MOTOR NOM POWER	→	0.0 kW
99.10 MOTOR ID RUN	→	ID MAGN
99.11 DEVICE NAME	→	
10 DIGITAL INPUTS		
10.1 BRAKE ACKN SEL		DI1
10.2 ZERO POS SEL	!	NOT USED
10.3 SLOWDOWN-N SEL	!	NOT USED
10.4 FAST STOP-N SEL	!	NOT USED
10.5 POWER ON ACKN SEL	→	NOT USED
10.6 SYNC SEL		NOT USED
10.7 CHOPPER FLT-N SEL		NOT USED
10.8 STEP REF2 SEL		NOT USED
10.9 STEP REF3 SEL		NOT USED
10.10 STEP REF4 SEL		NOT USED
10.11 HIGH SPEED SEL		NOT USED
10.12 SNAG LOAD-N SEL		NOT USED
10.13 ACCELERATE SEL		NOT USED
10.14 FB STOPLIM SEL	→	NOT USED
10.15 ELSHAFT ON SEL		NOT USED
20 LIMITS		
20.1 MINIMUM SPEED	→	(calculated)
20.2 MAXIMUM SPEED	→	(calculated)
20.3 MAXIMUM CURRENT A	→	2 * I_{hd} (A)
20.4 MAXIMUM TORQUE	→	200 %
20.5 MINIMUM TORQUE	→	-200 %
20.6 OVERVOLTAGE CTRL		OFF
20.7 UNDERVOLTAGE CTRL		ON
20.10 SPEED LIMIT AI3		100%
21 START/STOP		
21.1 START FUNCTION		CONST DC-MAGN
21.2 CONST MAGN TIME	→	500 ms
23 SPEED CTRL		
23.1 GAIN	→	15.0
23.2 INTEGRATION TIME	→	0.50 s
23.3 DERIVATION TIME		0.0 ms
23.4 ACC COMPENSATION		0.00 s
23.5 SLIP GAIN		100.0 %
23.6 AUTOTUNE RUN ?		NO
23.7 FEEDB FILTER TIME		4 ms
23.8 SPEED STEP		0.0 rpm
50 PULSE-ENCODER (visible when 98.1 = yes)		
50.1 ENCODER PULSE NR	→	1024
50.2 SPEED MEAS MODE		A_-_B_-_
50.3 ENCODER ALM/FLT		FAULT
50.4 ENCODER DELAY		1000 ms
50.5 SPEED FEEDB USED		TRUE
51 COMM MODULE (visible when 98.2 = yes)		
51.1 MODULE TYPE		
51.2…51.15 (See manual for fieldbus module used)		

62 TORQUE MONITOR		
62.1 TORQ MON SEL		TRUE
62.2 SP DEV LEV		10 %
62.3 TORQ FLT TD		600 ms
62.4 SP DER BLK LEV	→	13 % /s *)
63 FAST STOP		
63.1 FAST STOP TYPE 11	→	NOT USED
63.2 FAST STOP TYPE 12		NOT USED
64 CRANE		
64.1 STAND ALONE SEL	!	FALSE
64.2 CONTIN GEAR		FALSE
64.3 HIGH SPEED LEVEL 1		98 %
64.4 DEADZONE A		0 %
64.5 DEADZONE B		0 %
64.6 REF SHAPE		20
64.7 SLOWDOWN SPEEDREF		25 %
64.8 ZERO POS OK TD		0.3 s
64.9 TORQUE REF SCALE		1.00
64.10 CONTROL TYPE		JOYSTICK
64.11 MINIMUM REF		0.0 %
64.12 JOYSTICK WARN TD		400 ms
64.13 STEP REF LEVEL 1		10 %
64.14 STEP REF LEVEL 2		25 %
64.15 STEP REF LEVEL 3		50 %
64.16 STEP REF LEVEL 4		100 %
66 TORQUE PROVING		
66.1 TORQ PROV SEL	→	FALSE
66.2 TORQ PROV FLT TD		0.5 s
66.3 TORQ PROV REF		20 %
68 POWER OPTIMIZATION		
68.1 POWOP SELECT	→	FALSE
68.2 BASE SPEED	→	100 %
68.3 POWOP AUTOTUNE SEL		FALSE
68.4 INERTIA TOTAL UP	→	3 KGM^2
68.5 INERTIA TOTAL DWN	→	30 KGM^2
68.6 TQLIM UP	→	100 %
68.7 TQLIM DWN	→	75 %
68.8 POWOP RESET LEV		12 %
68.9 T MAX	→	500 %
69 REFERENCE HANDLER		
69.1 SPEED SCALING RPM	→	1500 rpm
69.2 ACC TIME FORW	→	5.0 s
69.3 ACC TIME REV	→	5.0 s
69.4 DEC TIME FORW	→	5.0 s
69.5 DEC TIME REV	→	5.0 s
69.6 S-RAMP TC		0.0 s
69.7 RAMP SCALE LOCAL		2.0
69.10 RAMP RATE=1		TRUE
98 OPTION MODULES		
98.1 ENCODER MODULE	→	NO
98.2 COMM. MODULE	→	NO
98.3 CH3 NODE ADDR		1
98.4 CH0 NODE ADDR	→	1
98.5 DI/O EXT MODULE 1		NO
98.6 DI/O EXT MODULE 2		NO
98.7 AI/O EXT MODULE		NO

*) Calculate as: 100 / (RT x 1.5) %/s
where RT = longest ramptime in sec.

→ Typical parameter values to check during start-up. If required, alter the values to meet the needs of your application. A complete parameter list is provided in Appendix A.

! Parameter value different from default setting

FUNCTION BLOCK DIAGRAM

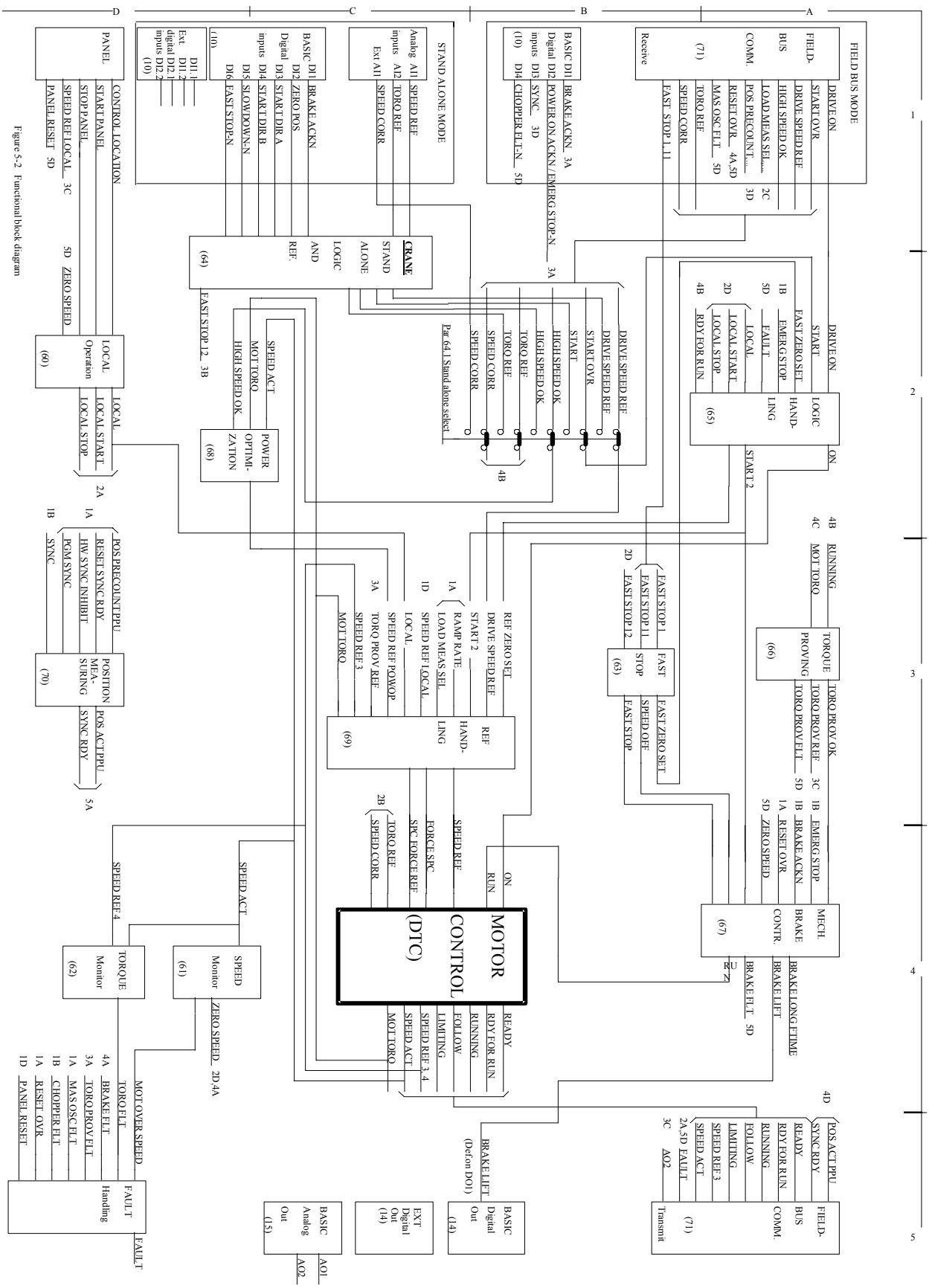


Figure 5-2 Functional block diagram

Figure 5-8 Function Block Diagram

5.6 Function Module Description

5.6.1 Local operation (60)

This function module contains the necessary logic for Local mode operation by the operator's panel on the front of the frequency converter. Normally used only for commissioning and maintenance. The unit is-receives commands: Start/stop, Speed ref local, Local/remote and Reset from the panel. All crane drive functions (such as mechanical brake control) are active also in Local control mode (except power optimisation).

Please note that inputs for Slowdown limits, Stop limits and Fast stop are NOT active when running in Local control mode.
Speed correction references <u>are</u> active when running in Local mode.

Parameter (60.1) LOC OPER INH = " true " will force the drive to external control mode (LOCAL = " 0 "). The drive is then only controlled from the Field Bus communication or in Stand alone mode from I/O signals.

To be able to change the mode from External control to Local control or reverse the motor has to be stopped with brakes set, that is: ZERO SPEED = "1" and RUNNING = "0".

Local running is performed from the operators panel which contains push-buttons for START PANEL, STOP PANEL of the converter, and for controlling the speed of the motor up and down with the REF plus Up and Down Arrow push-buttons for Fast and Slow reference change respectively. Ramp times (par. 69.2 - 5) are in Local multiplied with a scaling factor: RAMP SCALE LOCAL (parameter 69.7, default = 2.0). The direction of the drive is changed with the push buttons Forward and Reverse.

Pressing Start push-button will give both ON = Magnetising and Start-order, ramping up per given speed reference.
If pressing Start on panel but no reference higher than ZERO SPEED LEV (67.6) given within the time LOC ZERO SPEED TD (60.3), than the drive will switch off again.

Pressing Stop push-button while running will ramp motor to zero speed, and switch motor magnetising off after the time OFF TD (65.2) if CONTIN ON (65.1) = False.
If pressing Stop push-button (a second time) when at zero speed the magnetising will be switched off = converter switched off.

NOTE: If using input signal Power On Ackn (parameter 10.5), the drive cannot be started in Local (or External) mode unless input selected for POWER ON ACKN = "1".

5.6.2 Speed monitor (61)

The function module is used to supervise overspeed of the motor, to give tripping signal at motor overspeed.

If the motor speed exceeds the level determined by MOT OVERSPEED LEV (61.3) then the drive is tripped instantanuously (converter Off + brakes set) via the signal MOT OVER SPEED, indicating fault on panel, to Fieldbus and faultlogger.

5.6.3 Torque monitor (62)

The function module is used to supervise the torque of the motor by checking that the motor is following the speed reference in terms of direction of change during accel-/deceleration and without excessive speed error during accel-/deceleration and normal running.

For the supervision to be active TORQ MON SEL (62.1) has to be set ”True”.

If the absolute value of the speed error (SPEED REF4 - SPEED ACT) is higher than SP DEV LEV (Parameter 62.2) for a time longer than TORQ FLT TD (Parameter 62.3), the drive trips for torque fault; TORQ FLT, indicating fault to panel, Fieldbus and faultlogger.

Parameter SP DER BLK LEV (62.4), rate of actual speed change in % per second, can be set so that it blocks the protection during acceleration and deceleration. As long as the actual rate of change (derivative) of the motor speed during acceleration or deceleration is higher than the setting of parameter SP DER BLK LEV, the torque fault protection is blocked.

Example: Acceleration ramp times set to e.g. 5 seconds. With SP DER BLK LEV set to 8 %/s, the drive will not trip for torque fault if reaching torque limit during acceleration, as long as the actual acceleration time (0-100%) is below 12.5 seconds (100% / 8%/s = 12.5 s).

5.6.4 Fast stop (63)

The module contains logic for fast stopping the drive.
Three different types of fast stop can be obtained with this module.
They are:
- With torque limit only = fast stop 1
- With torque limit and mechanical braking = fast stop 2
- With mechanical braking only = fast stop 3

Note that fast stop is not to be mixed up with emergency stop.
NOTE: Fast stop functions are not active when in Local control!

The module has three output signals to achieve the different fast stops.
FAST ZERO SET is set to ” 1 ” when fast stop 1 is ordered, i. e. fast stop with torque limit only (brake is applied at zero speed).
All three signals FAST ZERO SET, SPEED OFF and FAST STOP are set to ” 1 ” when fast stop 2 is ordered, i. e. stop with both current limit and mechanical breaking.
FAST STOP is set to “1” when fast stop 3 is ordered, i.e. fast stop with mechanical braking only.

To run the drive again after reaching zero speed, the START-signal must be reset before accepting a new start-order.

There are two input signals from the Fieldbus Command Word (DS1.1), FAST STOP 1 and FAST STOP 11 to order fast stop (active in both Fieldbus and Stand alone mode):

-FAST STOP 1 = ” 1 ” gives fast stop 1
-FAST STOP 11 = ” 1 ” gives a fast stop per selection parameter 63.1 FAST STOP TYPE 11

Please note that drive cannot be started from External control place, if any of FAST STOP 1 or FAST STOP 11 (if activated in 63.1) control bits are active =“1”. Local start (from e.g. CDP panel) is possible.

To use FAST STOP 11 for:
Fast stop 1: set FAST STOP TYPE 11 (63.1) = FAST STOP 1
Fast stop 2: set FAST STOP TYPE 11 (63.1) = FAST STOP 2
Fast stop 3: set FAST STOP TYPE 11 (63.1) = FAST STOP 3

When using Stand alone modes there is also a signal FAST STOP 12, activated by digital input e.g. DI6 (FAST STOP-N) = “0” (see function module CRANE (64) for more details), which can be programmed to give anyone of the three types of fast stop. This is done with parameter 63.2 FAST STOP TYPE 12.

For settings of FAST STOP TYPE 12 see FAST STOP TYPE 11 above.

Note: If in Stand alone mode selecting the Control type (parameter 64.10) = FB JOYSTICK, than both FAST STOP 12 through digital input as well as FAST STOP 1 and FAST STOP 11 through the Fieldbus Command Word are available to use.

Any active Fast stop is indicated in signal 4.5 FB AUX STATUSWORD bit 11.

5.6.5 Crane (64)

NOTE: Stand Alone mode is active if parameter 64.1 STAND ALONE SEL is set = "True".

Table 5-3 Stand Alone default I/O signal interface and functions.

Signal	***Input (DI set in Group10)***	***Function***
BRAKE ACKN	DI1	Brake acknowledge from aux. contact on brake contactor (and from brake)
ZERO POS	DI2	Zero position contact from joystick
START DIR A	DI3 (fixed)	Direction A (pos.=up) from joystick, to be connected in series with Stop Lim A and contact from mechanical overload protection equipment
START DIR B	DI4 (fixed)	Direction B (neg.=down) from joystick, to be connected in series with Stop Lim B and contact from slack rope protection equipment
SLOWDOWN-N	DI5	Slow down lim A and B. Direction from START DIR inputs. After a power down (main contactor off) only slow speed is possible until this input is "1".
FAST STOP-N	DI6	Fast stop signal to the converter
SPEED REF	AI1 (fixed)	Speed reference signal from joystick. 0-10 V (or "par. 13.7"-10V) for 0-100 %
TORQ REF	AI2 (fixed)	Torque reference signal from joystick. 0-20 mA for 0 to maximum torque reference (maximum set with Parameter 64.9 TORQ REF SCALE).
SPEED CORR	Ext AI1 (fixed)	Speed Correction signal from e.g. electric shaft control unit. 0 – (+/-)10V for 0 - (+/-)100% speed correction signal.
BRAKE LIFT	DO1	Output to brake contactor
WATCHDOG-N	DO2	Closed contact indicates "healthy" drive. Open contact makes hardwired emergency stop; main contactor(s) off and brakes on.
FAULT-N	DO3	Fault (trip) signal indication
MEAS VALUE 1	AO1	Default selection: Motor speed
MEAS VALUE 2	AO2	Default selection: Motor torque

Joystick control mode (64.10=JOYSTICK)

When connecting a joystick directly to the drive I/O, then parameter 64.10 CONTROL TYPE should be selected to “JOYSTICK” (= default).

ANALOGUE REF INPUTS: The analogue reference signal (0 - max. reference) is connected to Analogue input 1 for speed reference, and to Analogue input 2 for torque reference. The sign for the reference, speed as well as torque reference is given by inputs DI3 (Start Dir A) for positive reference (=up for hoist) and DI4 (Start Dir B) for negative reference (=down for hoist). With parameter 13.7 “AI1 0% REF LEV” the minimum AI1 voltage level corresponding to 0% speed reference is set (used e.g. with 4-20mA signal).

REFERENCE CURVE: The joystick for giving reference has parameters for setting of the deadzone in direction A and B (64.4 and 64.5).
REF SHAPE (64.6) is for giving the reference a parabolic shape.
Parameter set to ”0” = straight line, “20” = X^2 and ”100” = X^3 curve.

JOYSTICK CHECKS: The drive is stopped (normal deceleration ramp if speed control) and prevented from a new start until the joystick is moved back to the neutral position, i.e. Zero Position (ZERO POS: e.g. DI2 = “1”, DIR A: DI3 = “0” & DIR B: DI4 = “0”) indicated longer than time ZERO POS OK TD (64.8), if any of following conditions (joystick or wiring problems) occur for a duration longer than JOYSTICK WARN TD (64.12):

- START DIR A= ”1” **and** START DIR B=”1” at the same time.
- SPEED REF is > 1V or TORQUE REF is > 2mA when joystick is in the neutral position (ZERO POS = “1”, DIR A = “0” and DIR B = “0”). Indicates a possible loose ground connection.

Panel also indicates this with an alarm text: “WARNING JOYSTICK”.

START: The drive is started when one of the signals START DIR A or START DIR B is ”1” and ZERO POS is “0”, unless any of the above listed fault conditions occur. The sequence starts with a magnetising phase = ON (unless already magnetised) which is immediately followed by the reference ramp-up. At a normal stop the switching off of the magnetising current is off-delayed by an adjustable time (parameter 65.2 OFF TD).
Power-up: Start order is not accepted after READY signal is active, until joystick is first in zero position.

SLOWDOWN: The speed is limited by a preset level (parameter SLOWDOWN SPEEDREF 64.7) if the SLOWDOWN-N input e.g. DI5 is zero-set. The converter remembers the direction of movement and allows full speed in the opposite direction as long as the supply voltage (AMC board supply) is not switched off. If the voltage has been switched off and the input SLOWDOWN-N = ”0” than only slow speed is allowed in both directions.
By setting parameter 10.3 SLOWDOWN-N SEL = DI5 + DI6, separate inputs are available for wiring of slowdown limit switches to the drive. Slowdown direction A is wired to digital input 5 and slowdown direction B is wired to digital input 6. If input 5 is open, speed is limited to slowdown reference level in positive (A) speed direction (e.g. upwards), but no limitation for negative speed (e.g. downwards) operation. And vice versa if input 6 is open. If both inputs 5 and 6 are closed (“1”), there is no slowdown speed limitation active - full speed allowed.

Slowdown selection “DI5 + DI6” is also possible to use when operating in Fieldbus mode.

FAST STOP: When the FAST STOP-N input e.g. DI6 changes to “0” (activates on a negative edge) while running, the drive is fast stopped (active in both speed and torque control). Three alternatives Fast Stop 1 = Torque limit braking, Fast Stop 2 = Torque limit and mechanical braking or Fast stop 3 = Mechanical braking can be selected from by parameter FAST STOP TYPE 12 (63.2).
After reaching zero speed and the “ZEROPOS” input has been set to ”1”, with a positive edge required for reset of fast stop condition, for a time longer than parameter ZERO POS OK TD, start of the drive is allowed. That is: the joystick must be returned to the neutral position for a minimum of 0.3 seconds (default value) before starting in other direction is possible.

To avoid running in the same direction (hoisting after overload indication or lowering after slack rope indication) the appropriate direction input must be wired in series with an additional contact from the protection equipment. These contacts must be of “NO” type and are closed when the protection equipment is energised and opens when a fault occurs.

TORQUE CONTROL is activated when the current level of input AI2 TORQ REF the first time (after each power on) passes the level 2 mA, and if the speed reference to AI1 is below 1V.

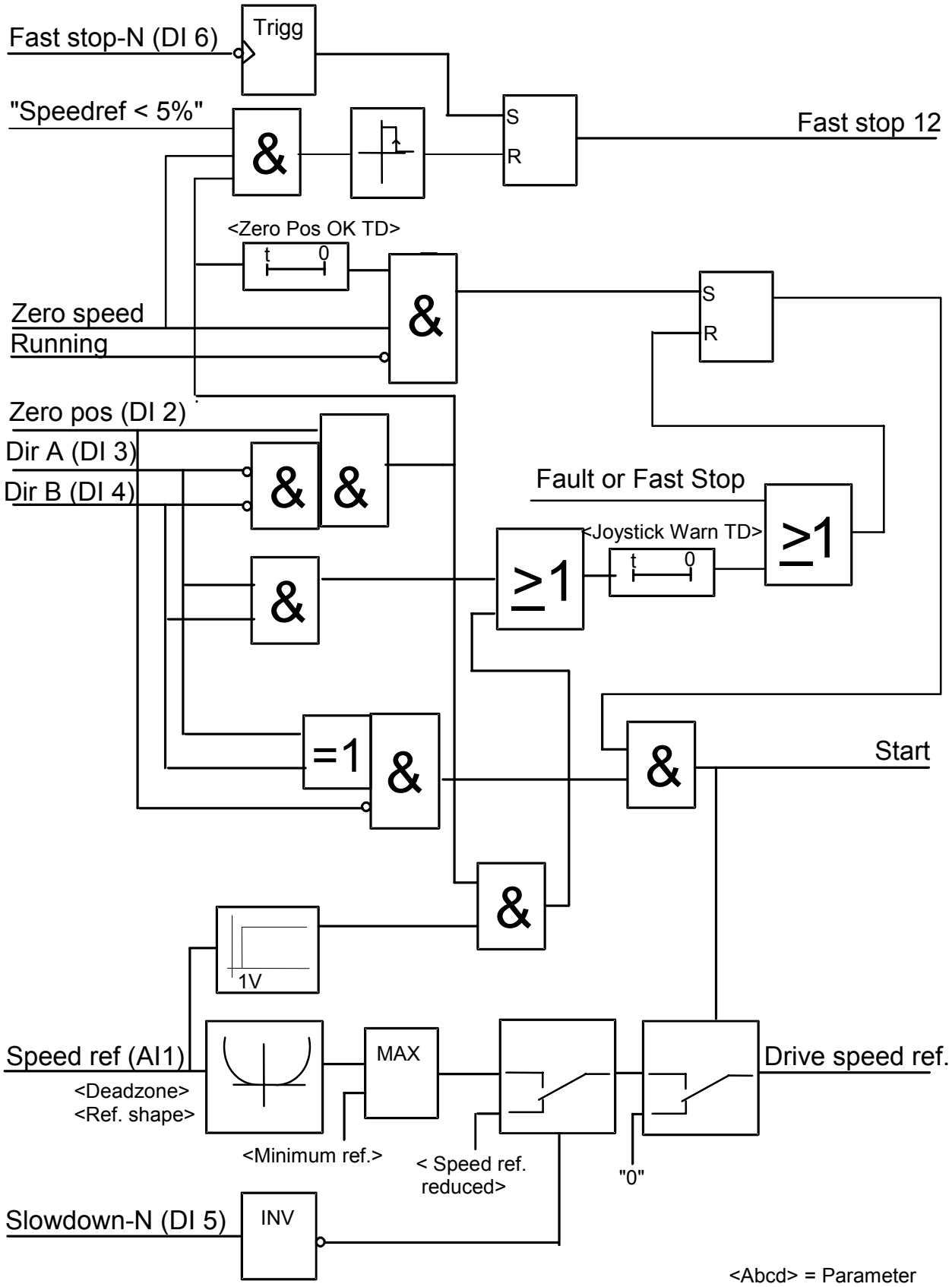
Speed reference is activated the first time AI1 passes the level 1V (and after each power on = default).
If both inputs are above limit, than speed control is active.
Updating time for speed and torque references are 32 ms.

If a slowdown limit switch is activated, drive will change to speed control and limit speed to slowdown speed reference level set.

SPEED CORRECTION: The additional speed reference input Speed Correction (Ext AI1 = RAIO input AI1) is a reference **without any ramp** that is added to the output of the normal speed reference ramp generator. Can be used as a correction input from a “electric shaft” control unit. Updating time is 8 ms for the speed correction input.
0 V signal is 0 % reference level and the 0 – (+)10 V range corresponds to 0 – (+)100 % speed. 0 – (-) 10 V range corresponds to 0 - (-)100 % speed.
Additionally the fieldbus Speed correction signal (DS3.2) can also be used (added to Ext AI1 signal) in Stand alone mode.
The speed correction reference is limited so that the sum of the normal “ramped” speed reference and the speed correction reference cannot exceed Maximum/Minimum Speed setting (parameters 20.1 & 20.2).

WATCHDOG: The signal WATCHDOG-N (digital output 2 as default) is used to indicate a healthy drive. This output is zero-set if the software detects any of the following faults:
Fieldbus communications fault (MAS OSC FLT)
- Master/Follower bus (Ch2) communication fault
- Brake long falling time
- Chopper fault (e.g. short circuit or overload)
- External fault
- CPU stalls out

If this relay output contact opens, the supply contactor to the converter must immediately be opened and mechanical the brakes applied by removing power from the brake contactor = emergency stop of the crane drive.



CRANE stand alone logic using Joystick Control type

Figure 5-9 Crane Stand Alone logic in Joystick mode

Radio control mode (64.10=RADIO CTRL)

If the joystick is connected to **and monitored** by an external unit such as a Radio controller or PLC, then Control type “Radio Control” (parameter 64.10) can be used. The differences from “Joystick” control are:
- The “Zero Pos” input signal (e.g. DI2) is not used/required.
- If receiving both direction orders “Start Dir A” and “Start Dir B” at the same time, the start order and reference are interlocked while the error occurs, but no indication is given to the panel nor any requirement for both signals to be zero before releasing the interlock
- No check of reference level is made before responding to the start order.

Reference inputs for speed, torque and speed correction reference (AI1-Ext AI1) have the same scaling and functions as in “Joystick” control mode.

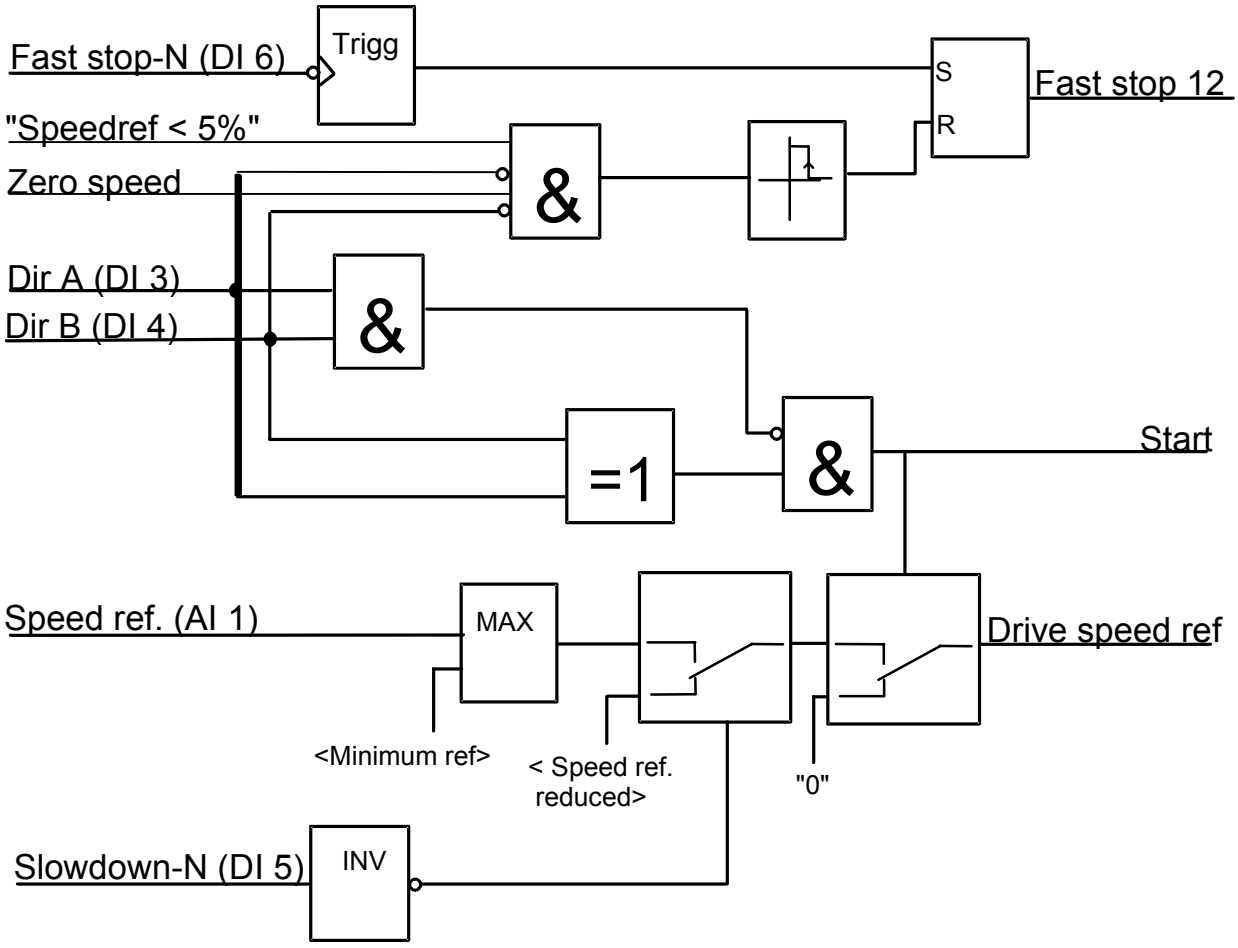


Figure 5-10 Crane Stand Alone logic in Radio Control mode

Motorised Potentiometer control mode (64.10=MOTOR POT)

If using (for example) a pendant controller with push-buttons for start and increase speed, then Control Type (parameter 64.10) should be set to “Motor Pot”.

“Start Dir A” and “Start Dir B” contacts connects to DI3 & DI4. “Increase” contacts should be connected in parallel to DI2 (activated by setting parameter 10.13 ACCELERATE SEL = DI2).

The Drive will start and accelerate on ramp towards (+ or -) 100 % speed if both direction and increase inputs are activated (= closed). If increase order is removed before reaching 100 % speed, drive will stop accelerating and run with the speed level reached. With a new increase order the drive will continue to accelerate towards 100 %.
If direction order is removed, the drive will decelerate on ramp towards 0 % speed. Reclosing the direction contact before reaching 0 % speed will stop deceleration and hold speed at the level reached.

Inputs AI1 and AI2 are inactive in this control mode. Other inputs have normal functions.

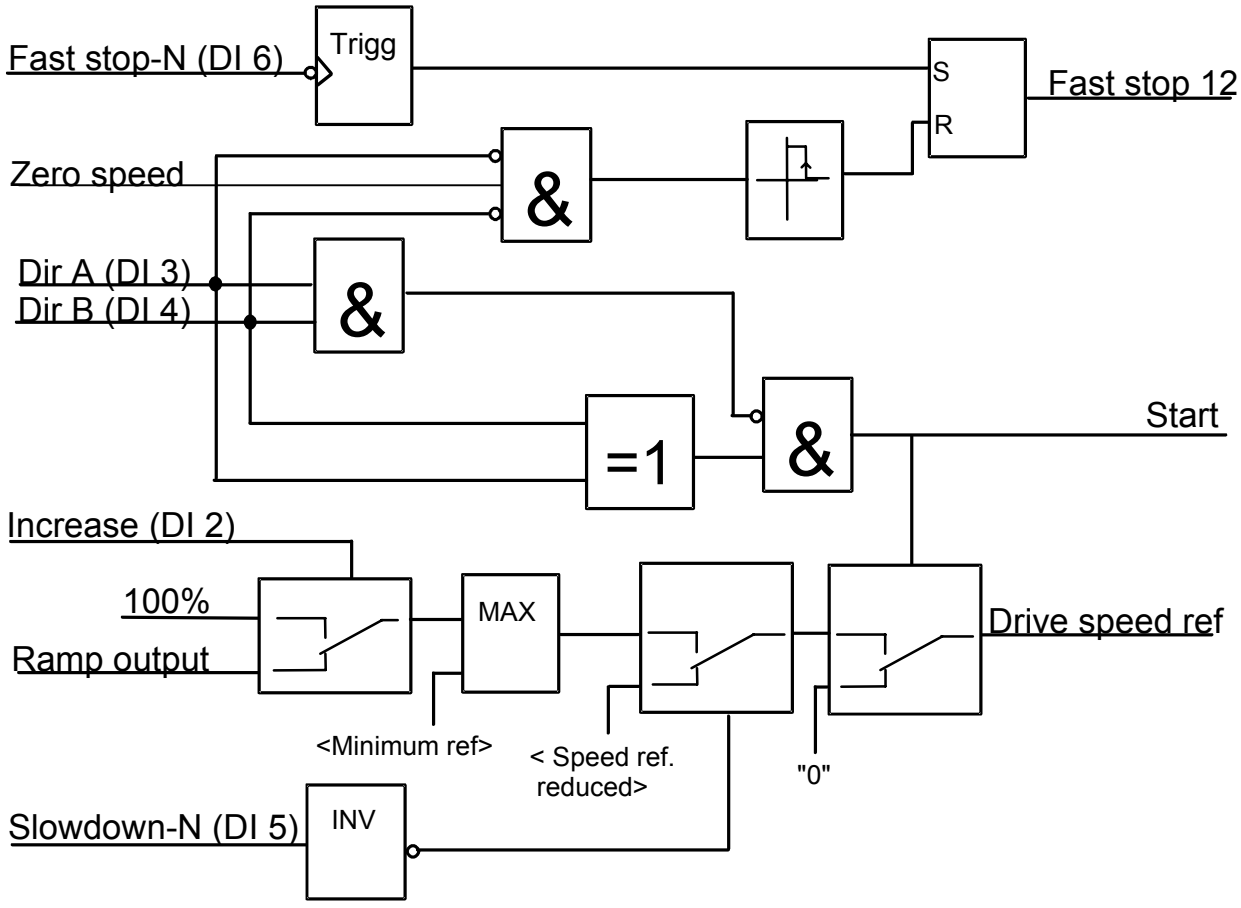


Figure 5-11 Crane Stand Alone logic in Motorised Potentiometer

NOTE: “Motor pot” mode does not work if drive is using Scalar control mode.

Step joystick reference mode (64.10=STEP JOYST)

When using a step type joystick having reference contacts instead of an analogue potentiometer, the control mode STEP JOYST (parameter 64.10) should be used. Up to 4 different speed levels are supported, direction order giving first speed level + 3 more contacts for different speed levels. Contacts can be connected to selectable digital inputs (including extended I/O modules), see parameters 10.8 STEP REF2 SEL, 10.9 STEP REF3 SEL and 10.10 STEP REF4 SEL. The corresponding speed reference levels are set with parameters 64.13 SPEED REF LEVEL 1 up to 64.16 SPEED REF LEVEL 4.

All lower step reference contacts must remain closed for next level to be active.
Example: when closing contact corresponding to Step reference level 4, contacts for level 2 and level 3 must still be closed.
Note that Zero Pos signal from joystick is required in this mode, similar to control mode JOYSTICK. Joystick monitoring function is active.

Step radio reference mode (64.10=STEP RADIO)

When using a radio controller or PLC having step reference output contacts, the control mode STEP RADIO (parameter 64.10) can be used. Maximum 4 different speed levels available.
Digital inputs and speed reference levels are selected as described above with Step Joystick mode.

Zero Pos input signal is not required in this control mode. Joystick monitoring is not active.

FB JOYSTICK control mode (64.10 = FB JOYSTICK & 64.1 = True)

This mode is used if the joystick I/O is wired to a PLC which has fieldbus communication to the CraneDrive drive, and we still want to use the Stand alone mode (CRANE module).

When FB Joystick mode is selected the drive is reading signals START DIR A, START DIR B, ZERO POS and the Reference from fieldbus datasets instead of the digital inputs DI2, DI3, DI4, and analog input AI1.

Dataset 5 word 1 from PLC is used with the following bit mapping:

Dataset 5 Word 1: Aux Command word

Bit number	***Signal***	***Range***	***Description***
0 = Bit 0, LSB	FB ZERO POS	”1”, ”0”	Joystick Zero Position signal
1	FB START DIR A	”1”, ”0”	Joystick direction A signal (pos.=up)
2	FB START DIR B	”1”, ”0”	Joystick direction B signal (neg.=down)
3	FB JOYST TQ CTRL	”1”, ”0”	Joystick torque control enable
4	FB ELSHAFT ON	“1”, “0”	Electric shaft control on

Bits 0 – 2 are used for sending the joystick signals from PLC. Dataset 1 word 2 DRIVE SPEED REF (see section 5.5.12 for scaling information) is used for sending the joystick analog reference (without sign) in FB JOYSTICK mode.

If using torque control, bit 3 in dataset 5 word 1 should be set to “1”. The torque reference (without sign) is then sent with dataset 1 word 3 TORQ REF (see section 5.5.12 for scaling information).

Bit 4 FB ELSHAFT ON is only used with Electric shaft control, see section 5.5.14 for details.

Slowdown limit switches can still be wired to the drive digital input(s), selections per parameter 10.3 SLOWDOWN-N SEL.

End limit switches can be wired to drive digital inputs DI3 + DI4, see parameter 10.14 FB STOPLIM SEL, when FB JOYSTICK mode is used (also available in Fieldbus mode).

When using FB JOYSTICK mode the fieldbus Command word, dataset 1 word 1 (see section 5.5.12) can be used except for the following bits that are <u>not</u> active: START OVR and TORQ CTRL.

Please note that the fieldbus communication supervision is active: Comtest toggle bit in Command word + Status word must be connected in the PLC program (see section 5.5.12) to avoid communication fault in drive!

5.6.6 Logic handler (65)

Contains logic for on-, off and start-order.

On is the motor magnetising command and start command releases speed and torque controllers. To get an On-order to the converter the signal ON must become ” 1”. This can only be obtained if no off order is issued which means if:
- Power On Ackn (e.g. DI2) = “1”.
- Converter is not tripped (FAULT = ” 0 ”)
- The button ” 0 ” at the panel is not pushed (LOCAL STOP = ” 0 ”)

When an “On signal” is given either in local mode with the panel LOCAL START or in remote mode with the signal DRIVE ON (field bus mode) or START DIR A/ START DIR B (stand-alone mode) to get the signal ON, then a signal Ready For Run is awaited, acknowledging that the motor is magnetised. If this acknowledgement is not received within 5 seconds the ON-order signal is reset to zero.

Off order is given by the panel LOCAL STOP at zero speed (stop push-button on panel) or in external control when signal DRIVE ON is set to ”0” (field bus mode).

If parameter CONTIN ON (65.1) = ” false ” and running becomes ” 0 ” the ON signal will be reset to ” 0 ” after expired time OFF TD (65.2). This is a ” magnetising shut-off” function if the drive is not operated within the last OFF TD seconds.

“Start order” is issued when START 2 = ” 1 ”. In remote mode the signal START OVR (Fieldbus mode) or START DIR A / START DIR B (stand-alone mode) is giving this (the start order). In local mode the start order is given with signal LOCAL START (start push-button on panel).

No start order can be given unless the converter is “On” = magnetised, acknowledged by the signal Ready For Run.

Signal REF ZERO SET will hold the speed reference to ” 0 ” when Fast Stop is ordered.

See also timing and logic diagrams on the next 2 pages.

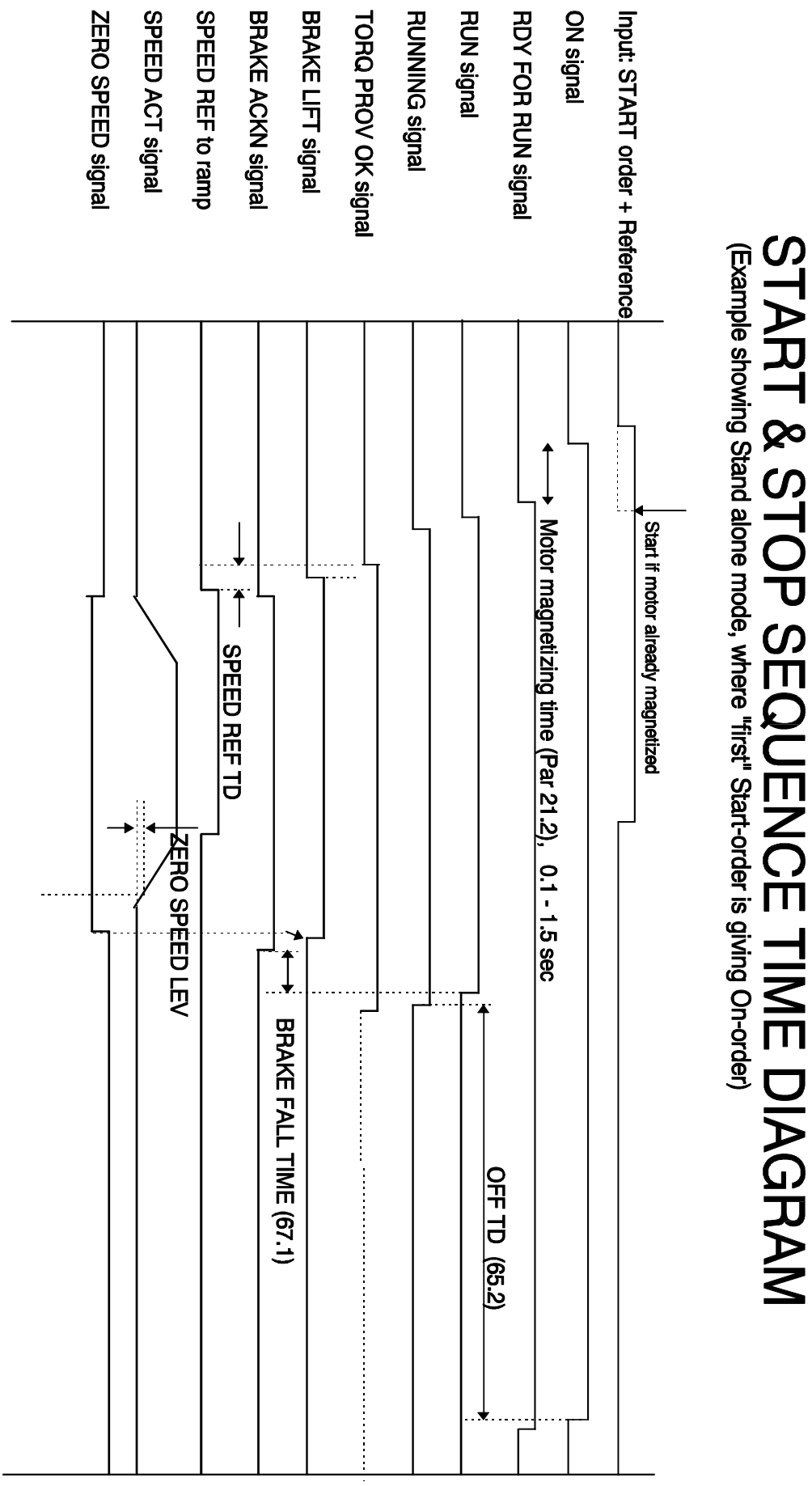
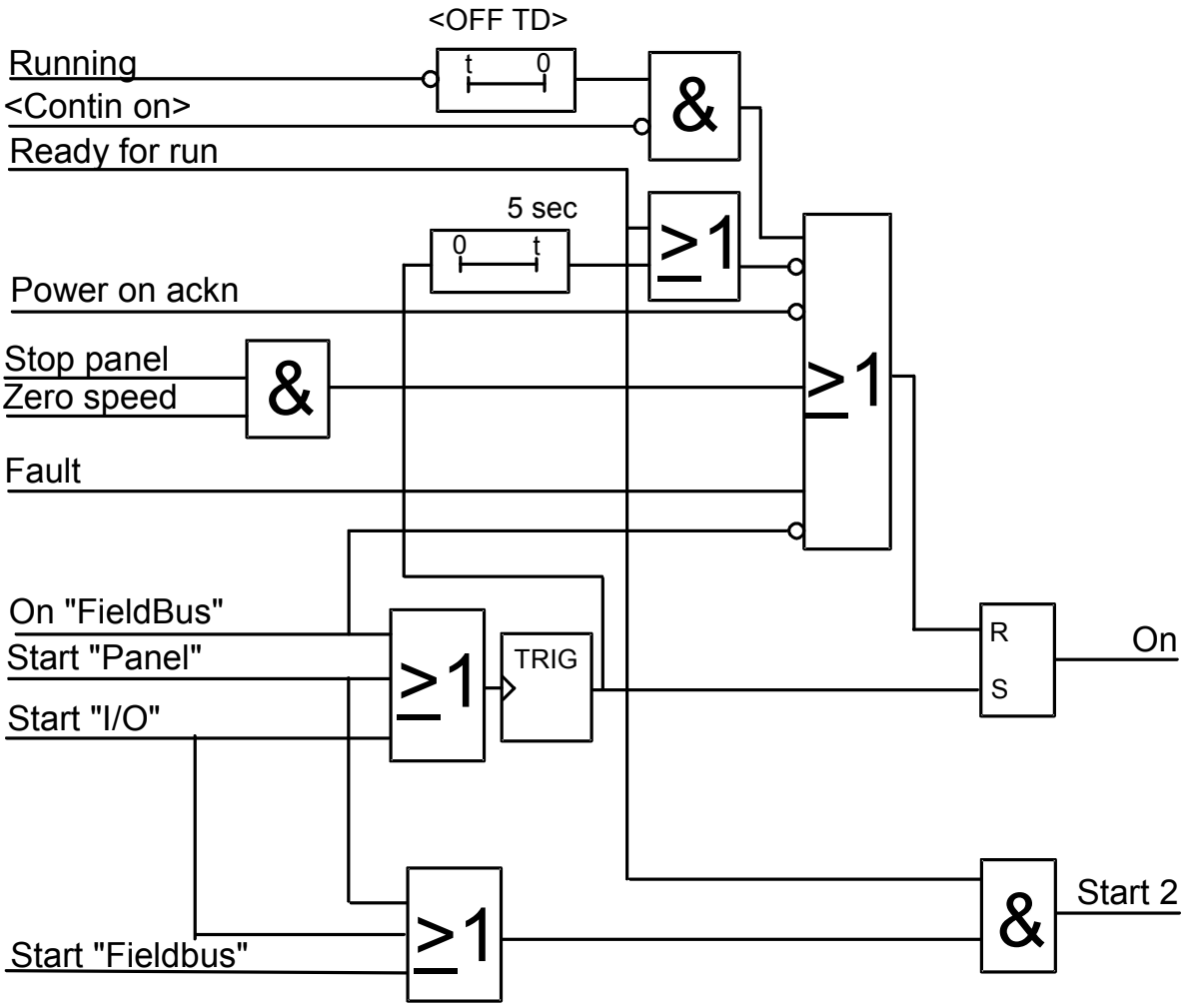

START & STOP SEQUENCE TIME DIAGRAM
(Example showing Stand alone mode, where "first" Start-order is giving On-order)
Input: START order + Reference
ON signal
RDY FOR RUN signal
RUN signal
RUNNING signal
TORQ PROV OK signal
BRAKE LIFT signal
BRAKE ACKN signal
SPEED REF to ramp
SPEED ACT signal
ZERO SPEED signal
Start if motor already magnetized
Motor magnetizing time (Par 21.2), 0.1 - 1.5 sec
OFF TD (65.2)
SPEED REF TD
BRAKE FALL TIME (67.1)
ZERO SPEED LEV

Figure 5-12 Start and stop sequence time diagram



Logic handler (65)

Figure 5-13 Logic Handler logic

5.6.7 Torque proving (66)

Torque proving is a function module included in the drive control to ensure, before releasing the brake and starting the crane operation, that the drive is able to produce torque, and that brakes are not slipping (signal “Zero speed”=1). The function module is mainly intended for hoist drives, but can also be used with other motions using encoder feedback.

Torque proving is performed by giving a positive torque reference with the brake applied. If torque proving is successful, that means torque reaches the correct level, the brake is lifted and the next step in the starting sequence is initiated.

The time to execute the torque proving sequence is so short (approximately 100 ms) that the operator does not experience any time delay in the starting sequence.

The torque proving is activated by setting:
- TORQ PROV SEL (66.1) = ” True ”

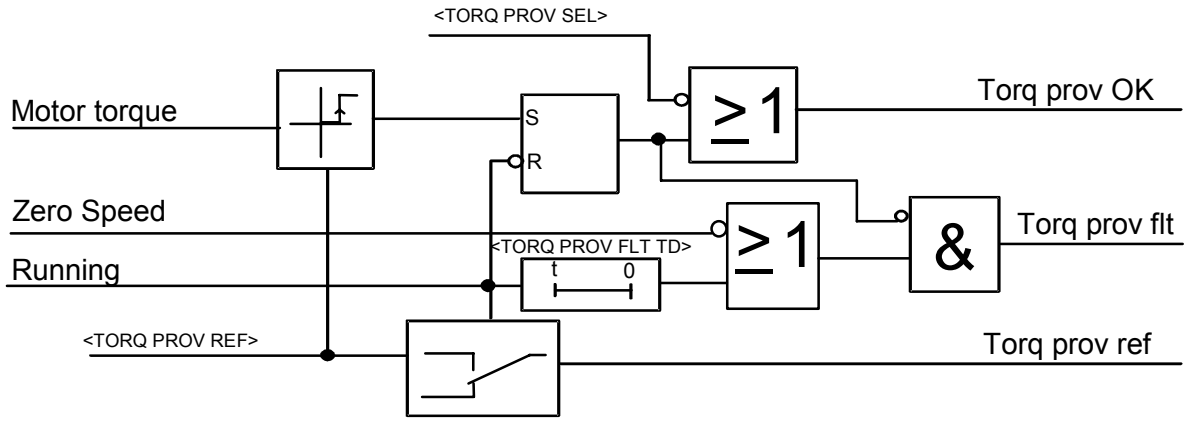
The torque proving reference, TORQ PROV REF (66.4) sets output signal TORQ PROV REF. The actual torque is read from signal MOT TORQ.

When the torque proving is activated but not yet performed, the output signal TORQ PROV OK is ” 0 ”

The torque proving sequence starts when the input signal RUNNING is ” 1 ”, i. e. when the converter is started. When the torque proving sequence is completed the output signal TORQ PROV OK is set to ” 1 ”.

If any fault is detected during the proving sequence, signal TORQ PROV OK does not go to ” 1 ” but output signal TORQ PROV FLT is set to ” 1 ” and the drive trips. A message is displayed on the drive panel and an indication given to the supervisory control.

NOTE: Torque proving is not active (even if selected with parameter 66.1) if the drive is in torque control mode.



Torque proving (66)

Figure 5-14 Torque Proving logic

5.6.8 Mechanical brake control (67)

The program supports electrical and mechanical braking to stop the motor. Electrical braking gives a controlled and smooth braking which is the most common way to bring a motor to stop. Mechanical braking should only be used in critical situations and if so there are two possibilities:
- Emergency stop (category 0 stop)
- Fast stop

The function module contains logic for controlling the mechanical brake. Output signal BRAKE LIFT (2.21) is the brake lift order. Brake lift acknowledgement is received as input (e.g. DI1) BRAKE ACKN.

In the starting sequence it is possible to set a rampstart time delay related to the brake actual lifting time with parameter 67.8 SPEED REF TD.

After the motor has come to zero speed during a stop (by electrical braking) the mechanical brake should be applied without unnecessary delay.

Detection of the motors zero speed rotation at stop:
While running the motor the output signal ZERO SPEED (signal 4.1:4) is ”0”. When the speed is below the level ZERO SPEED LEV (67.6) and the time ZERO SPEED TIME (67.7) has elapsed the signal ZERO SPEED becomes ”1”, indicating zero speed on the motor and the mechanical brake will be set if no start order exist.

Start sequence:
A brake lift is initiated by a start order i. e. brake control input signal START 2 = ”1”. This will set output signal RUN = ”1” releasing speed & torque controllers. After receiving TORQ PROV OK = ”1” and no stop orders are active the BRAKE LIFT is set ”1”. With a slow brake, start of the speed ref. ramp can be delayed with par. 67.8 SPEED REF TD.

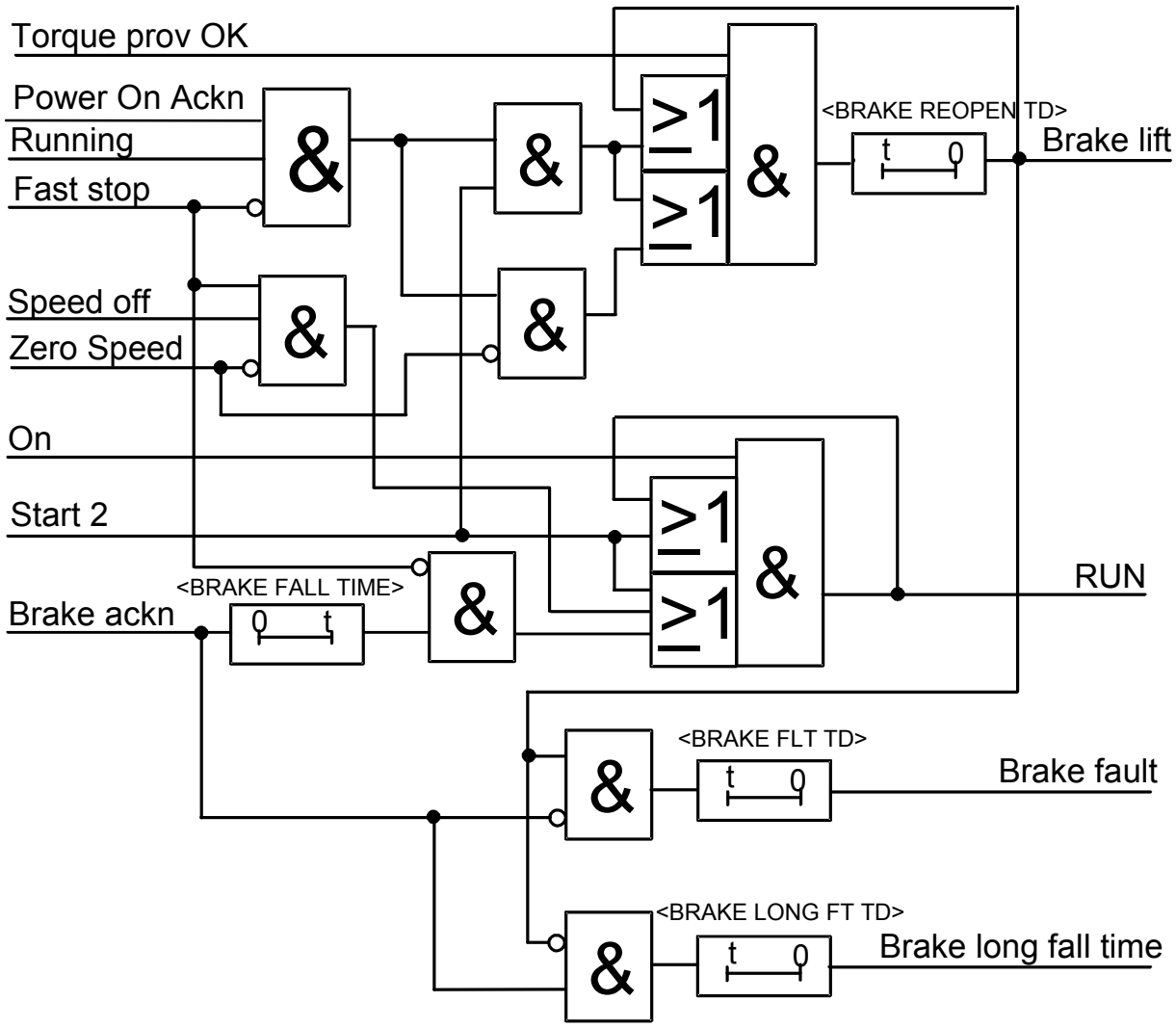
Normal stop sequence:
Removing the start order will set the reference to zero and the drive will, if speed controlled, ramp to zero speed (Reference handler). When the input signal ZERO SPEED = ”1” then BRAKE LIFT is set to zero. When receiving acknowledgement BRAKE ACKN = ”0” the RUN order is reset to ”0” after delay time BRAKE FALL TIME (67.1). Except at emergency stop (EMERG STOP = ”1” when Power On Ackn = 0 in Fieldbus mode) and fast stop (FAST STOP = ”1”) the brake module maintains the BRAKE LIFT and RUN order as long as ZERO SPEED is not detected.

With parameter 67.4 BRAKE REOPEN TD, a minimum time delay between a stop and next start, i.e. a “close brake order” (BRAKE LIFT=0) and next “brake lifting order” (BRAKE LIFT=1), can be set.

A brake fault, i.e. Brake Ackn (DI1) = 0 (during start or normal running) with a duration longer than setting of BRAKE FLT TD (67.2), activates an output signal BRAKE FLT that will trip the drive and indicate.

A long falling time at stop (Brake Ackn =1) with a duration longer than setting of BRAKE LONG FT TD (67.5), keeps torque on the motor and provides indication with an output signal BRAKE LONG FTIME to: panel, Fieldbus statusword and activates the Watchdog output contact (DO2) to make an emergency stop of the drive (brake and drive power off).

See also logic diagram on this page and timing diagram in chap. 5.6.6



Mechanical Brake Control (67)

Figure 5-15 Mechanical Brake Control logic

Conical motor function

This section describes how to handle the use of a conical motor (rotor displacement motor) with built-in brake instead of standard motor plus external mechanical brake. In a conical motor the rotor will move along it's length, thereby separating the brake disc mounted on the shaft from the counterpart mounted on the stator, as soon as magnetizing current is applied to the motor winding. When current is switched off at stop, rotor is pushed back closing the brake by spring force.

By setting parameter 67.11 MOTOR TYPE = CONICAL the conical motor function is activated. Following parameters will than automatically get the new default values below, suitable for use with conical motors (parameters are reset to normal defaults if par. 67.11 is set to STANDARD).

10.1 BRAKE ACKN SEL = INTERNAL ACK
21.2 CONST MAGN TIME = 30 ms
65.2 OFF TD = 0.0 s
67.1 BRAKE FALL TIME = 0.0 s
67.6 ZERO SPEED LEV = 3.0 %
67.7 ZERO SPEED TIME = 1000 ms

To minimize the "roll-back" (load dip) of a hoist conical motor when stopping, the flux is reduced during stop to a level set in parameter 67.12 RED FLUX LEVEL. Default value 75 % is sufficient for most conical motors, but for larger motors (30-40 kW) there can be a need to lower this value further to minimize the "roll-back". Note that during stopping when reducing the flux the motor current will increase proportional. Due to this there can be a need to check converter sizing to have enough current margin. Normally one size bigger converter is selected.

This flux reduction is only active if conical motor function is activated with parameter 67.11 (=CONICAL).

To minimize the "roll-back" (load dip) of a hoist conical motor at start, the flux level at start can be increased to a level set in parameter 67.13 START FLUX LEVEL (100 - 140 %) during a time set with parameter 67.14 START FLUX TIME.

With parameter 67.7 ZERO SPEED TIME it's possible to delay the closing of conical motor brake at stop. For example to get faster response to a new start order within this time.

NOTE: When making ID Run with a conical motor, the REDUCED type of ID Run must be selected in parameter 99.10 . The STANDARD type of ID Run cannot be used as it is making measurements with low flux levels, making conical motor stop.

Conical motors used on hoist applications must have an encoder speed feedback.

5.6.9 Power optimisation (68)

The power optimisation function module can only be used in drives with an active (pulling) load, i. e. in general only on hoist drives. Speed reference in hoisting direction must be positive value (Dir A).

When increasing the motor speed above motor nominal speed (base speed), field weakening is used. Field weakening, however reduces the maximum available torque of the motor. To ensure that the motor will always be able to produce sufficient torque for controlling the load in the field weakening range, a maximum allowed speed is calculated. This function is called power optimisation. This means that for a heavy load the maximum allowed speed is less than that of a light load.

Fieldbus mode: Speed reference from PLC (DS1.2) when accelerating hoist drive must be limited to Base speed level (set in parameter 68.2, e.g. 50%). If the power optimisation receives a logical 1 on the signal HIGH SPEED, from fieldbus Command word (DS1.1) bit 2 , telling that maximum speed is requested by the driver, the maximum speed reference in field weakening area (above base speed) calculated by power optimisation is than used as input to the ramp unit and the motor will accelerate up to the corresponding speed. When driver is reducing reference from maximum, the HIGH SPEED signal should be set = 0. The speed will now be below base speed unless PLC reference has been rescaled to be proportional to maximum reference (SPEED REF3 in DS4.1) reached during acceleration.

Stand alone mode: Speed reference is received through I/O (e.g. AI1 if JOYSTICK control mode) or from PLC (DS1.2) if FB JOYSTICK control mode selected (parameter 64.10 CONTROL TYPE used for Stand alone control mode selection). Speed reference is given as 0 – 100 % (% of parameter 69.1 SPEED SCALING RPM). The **minimum** of this requested reference and the reference calculated by power optimisation is than used as input to ramp unit. Note that parameter 64.3 HIGH SPEED LEVEL 1 should be set equal to the Base speed level (set in parameter 68.2) to get the HIGH SPEED signal correctly (this signal is created internally in Stand alone mode).

To be active the parameter POWOP SELECT(68.1) must be set ” True ”. Parameters TQLIM UP (68.6) and TQLIM DWN (68.7) are maximum load torque (power limits) in positive/negative running directions.
When the speed, during acceleration towards base speed, has reached 90% of base speed the module makes a calculation (using speed and torque measurements during 250 ms before reaching 90% of base speed) of the maximum allowed speed by the formula:

$$\text{maximum speed} = \frac{\text{BASE SPEED} * \text{TQLIM}}{\text{TORQ HOLD}}$$

TORQ HOLD is the torque needed to hold the load (this level is equal to the motor torque value you can see when reaching steady state = constant speed), and is calculated by the module during acceleration. If the module receives the order HIGH SPEED = ”1”, commonly given when the master switch is in its outermost position, output SPEED REF POWOP is set to the calculated maximum speed reference. The quality of the calculation depends on the measurements done before reaching 90% of base speed. The speed must have a linear acceleration and without excessive ripple.

The power optimisation output speed reference SPEED REF POWOP is set to zero if the input signal HIGH SPEED is set to “0”. The calculated maximum reference is reset to zero when the actual speed SPEED ACT has decreased to a speed corresponding to the parameter POWOP RESET LEV (parameter 68.8).
The calculated reference value (before the “HIGH SPEED switch”) can be seen in signal 2.25 POWOP SPEEDREF.

The TORQUE HOLD value mentioned above is continuously calculated by the power optimisation module. It’s available as signal LOAD TORQUE % (2.31), in % of the motor nominal torque. This signal is filtered with a filter time constant set in parameter 68.10 LOAD TORQ FILT TC.

This LOAD TORQUE signal is used to detect a “Slack rope” situation, that is load torque dropping below the level set in par. 68.11 SLACK ROPE TQ LEV. SLACK ROPE is indicated in signal 4.05 FB AUX STATUSWORD (DS12.1) bit 10. A detected slack rope will make a Fast stop1 of the drive. This Fast stop can be disabled via signal DISABLE SLACKROPE in fieldbus Dataset 5 Word 1: FB AUX COMMAND WORD (signal 3.07) Bit 7. Also setting of parameter 68.11 = -400% (default) will disable the Fast stop.

NOTE: When dimensioning the hoist motor it must be ensured that the available motor breakdown torque (T_{max}) in the frequency converter duty, is sufficient for the total torque required during acceleration (hoisting) and deceleration (lowering) in the field weakening area. The breakdown torque decreases proportionally to $1/n^2$ in the field weakening area!

Power optimising will during acceleration, using total torque measured (load + accel), calculate the maximum speed possible in field weakening without exceeding the motors stated breakdown torque TMAX (parameter 68.9). This value is used to limit the SPEED REF POWOP reference.

Commissioning instructions for the power optimisation.

This is an instruction how to adjust the parameters INERTIA TOTAL UP (68.4) , INERTIA TOTAL DWN (68.5) , TQLIM UP (68.6), TQLIM DWN (68.7) and TMAX (68.9).

1. Set the parameter POWOP SELECT (68.1) to ”True”. Also temporarily set 68.9 to maximum = 500%.

2. Set the parameter TQLIM UP (68.6) to the rated torque of the motor (100%).

3. Temporarily set the parameter TQLIM DWN (68.7) to 75% of rated torque of the motor. The reason to set TQLIM DWN lower than TQLIM FLD WEAK UP is to get about same speed in positive and negative directions, with a certain load on the hoist.

4. The parameters INERTIA TOTAL UP and INERTIA TOTAL DWN are acceleration constants in positive and negative direction. Use a load that is 75 - 100% of full load.

5. Set parameter POWOP AUTOTUNE SEL (68.3) to ” true ”. The tuning part is now activated for one autotune cycle.

6. Start the drive with base speed reference (from Local or External control) in positive (respectively negative) direction, and the motor will accelerate up to base speed. The motor will keep at base speed for about 4 seconds for calculation to be completed. If giving start and reference from External control place it’s required to disconnect HIGH SPEED OK signal during Autotune (in Standalone set par. 64.3=100%). Calculation is completed when actual signal no. 24 TOTAL INERTIA is showing a non-zero value. Stop the drive.

7. Read the actual signal no.24 TOTAL INERTIA on the panel.
   Repeat this procedure 2-3 times in each direction and calculate the average value for parameter INERTIA TOTAL UP and INERTIA TOTAL DWN respectively.

8. Set this value to parameter INERTIA TOTAL UP (68.4) or INERTIA TOTAL DWN (68.5) depending upon the direction. Reconnect HIGH SPEED OK signal (i.e. in Standalone, set par. 64.3 back to 98%).

9. Adjusting TQLIM UP and TQLIM DWN:
   Connect a load equal to the highest load specified to operate to max field weakening = 100% speed. Lower parameters TQLIM UP and TQLIM DWN to a low value, e.g. 40%. Testrun from joystick giving full reference up (resp. down). Check max speed reached. If not equal to 100%, than increase TQLIM UP (resp. TQLIM DWN) in steps of 5% until reaching 100% speed each time.

10. Now with this same load decrease TMAX 68.9 step-by-step and testrun up respectively down until you find the first value where speed starts to be limited below 100% in either up or down direction. Than slightly increase TMAX 68.9 to still reach 100 % speed both in hoisting and lowering direction.

An alternative to points 4 – 8 above for finding the Inertia values is:

Monitor signal 2.31 LOAD TORQUE % with DrivesWindow while making start and stop test runs (acceleration, constant speed for a couple of seconds and deceleration) with different settings on Inertia parameter. Any load 20 - 100% is possible to use. Do not run faster than base speed. First run in hoisting direction.

When you have found the correct value for parameter 68.4 INERTIA TOTAL UP, than signal 2.31 LOAD TORQUE % will show the same level during acceleration and deceleration as during constant speed. If the Load torque signal is showing a higher value during acceleration than during constant speed, the INERTIA TOTAL UP parameter should be increased. If lower value during accel. than during constant speed, than Inertia should be lowered.

Next make similar test runs in lowering direction to find correct value for parameter 68.5 INERTIA TOTAL DWN. If Load torque signal is now showing a higher value during acceleration than during constant speed, the INERTIA TOTAL DWN parameter should instead be decreased (and increased if showing lower value during accel).

5.6.10 Reference handler (69)

The function module includes:
- Setting of ramp times
- Handling of speed references
- Torque memory function

Setting of ramp times can be made for both acceleration and deceleration and can be set differently for forward and backward (or upwards and downwards) with parameters: 69.2 ACC TIME FORW, 69.3 ACC TIME REV, 69.4 DEC TIME FORW and 69.5 DEC TIME REV.

The possibility to use a scaling factor for the set ramp times is available in external (only in Fieldbus mode) and local control mode. In external control mode the scaling is done with signal RAMP RATE (DS3.1) from supervisory control, if parameter 69.10 “RAMP RATE=1” is set False. Parameter RAMP SCALE LOCAL (69.7) is used when running in local. Default setting is 2.0 (except for the Master drive in Master/Follower macro operation, then the setting is fixed at: 1.0), meaning that the actual ramp times when running in local control mode are double the settings of the ramp time parameters 69.2 - 69.5.

Speed reference when running in external Fieldbus control mode (64.1=False):
The drive is using the higher value from DRIVE SPEED REF or SPEED REF POWOP. The DRIVE SPEED REF is a reference up to base speed at start. Then if the power optimisation has calculated, for the actual load, that it is possible to run above base speed, it will use SPEED REF POWOP which brings the speed into the field weakening range. DRIVE SPEED REF should then normally be rescaled to ”follow” the maximum speed reached to have a smooth behaviour when decreasing the reference from the joystick (continuous gear).

When running in Stand alone mode (64.1=True), the drive is instead using the lower value of driver reference given (via AI1 or the DRIVE SPEED REF from PLC, if FB Joystick mode) and the SPEED REF POWOP.

Speed reference when running in local control mode is SPEED REF LOCAL and the direction is chosen with the direction push-buttons on the panel.

Speed reference output to speed controller can be delayed if having a slow acting brake (long lifting time) using the time SPEED REF TD (67.8).

The ramp unit is equipped with an S-curve function, for “smoothing” both the beginning and the end of the ramp. S-curve time constant is set with parameter 69.6 S-RAMP TC.

Parameter START TORQ SEL (67.9) is used for selecting type of **torque memory function**, to avoid “roll-back” at start on a hoist drive:

NOT USED = No extra starting torque

AUTO TQ MEM = Automatic torque memory will store the load torque needed when stopping and apply the same torque reference when

starting again. The value of parameter 67.10 START TORQ REF is used as a minimum value for the torque memory.

LOAD MEAS = Starting torque reference is received from a PLC (DS5.2 LOAD MEAS REF) or from the extended RAIO analog input 2 (connected e.g. from a load cell). The “Ext AI2” input is filtered with parameter 13.6 (also used for Ext AI1) and scaling is done with par. 64.9 TORQUE REF SCALE. Parameter 64.9 = 2.0 gives following scaling: Ext AI2= 10V corresponds to 200% starting torque reference.
NOTE: signal LOAD MEAS SEL from Fieldbus command word must be set “true” to enable the fieldbus reference from DS5.2.
The fieldbus DS5.2 reference and Ext AI2 reference are added together.

PAR 67.10 = Starting torque reference is set fixed equal to value given in parameter 67.10 START TORQ REF.

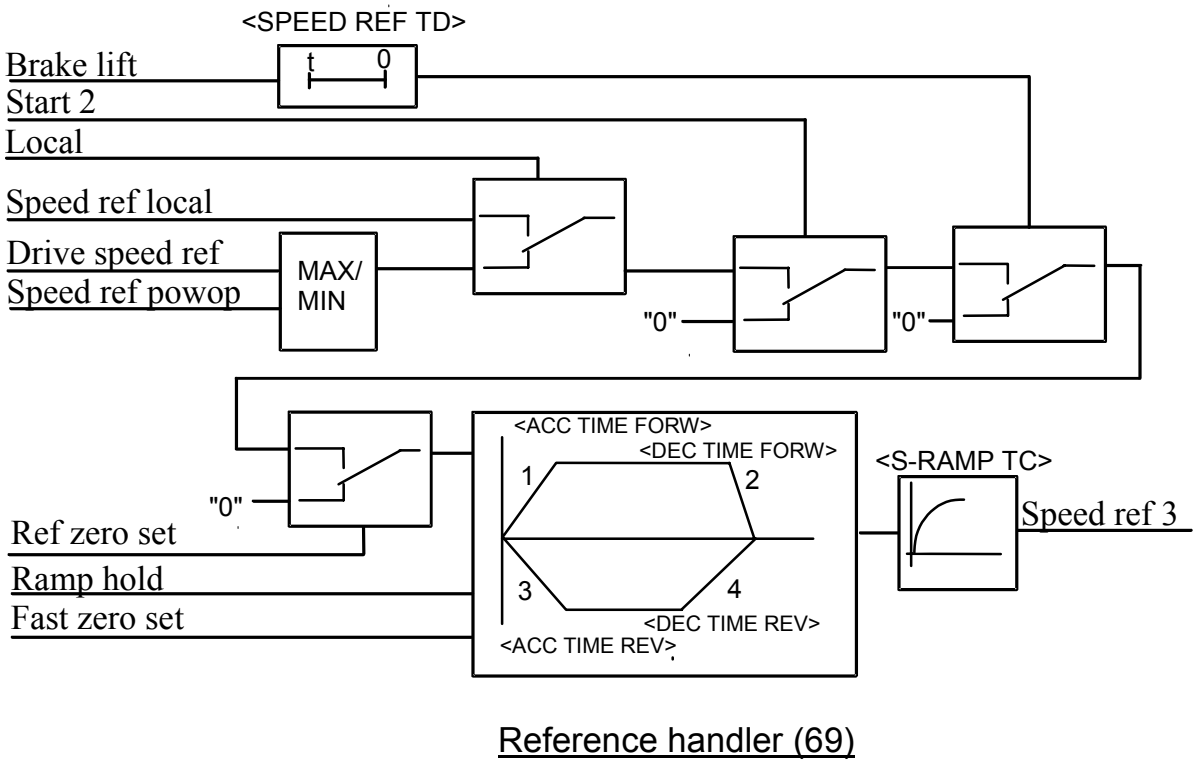


Figure 5-16 Reference Handler logic

5.6.11 Position measurement (70)

The function module is used to give a position measurement from a pulse encoder input RTAC or NTAC. Position measurement can be used in both Fieldbus and Stand alone modes.

The measurement can be synchronised to the value POS PRECOUNT PPU sent from the supervisory controller, either by signal PGMSYNC from the fieldbus Command word or from digital input hw-sync (parameter 10.6 SYNC SEL).
NOTE: Hw-sync from digital input is blocked when drive is not running (2.20 RUNNING = 0).

Acknowledgement of synchronisation is done with the signal SYNC RDY to the supervisory controller. Reset of the acknowledgement is done with signal RESET SYNC RDY from the supervisory controller.

Hardware synchronisation through e.g. DI.3 can be blocked if HW SYNC INHIBIT from supervisory controller = ” 1 ”. Synchronising edge of DI.3 is selected with parameter SYNC COND (70.2).

Measurement value POS ACT PPU sent to the supervisory controller is the number of pulses counted divided with the value of parameter POS SCALE (70.1).

The number of pulses counted depends upon the settings of parameters 50.1 Pulse Nr and 50.2 Speed Meas Mode. Default setting of Speed Meas Mode parameter is that both positive and negative edges from both A and B signals are counted.
Example: If 50.1 is set to 1024 ppr and 50.2 is set to default: “A_-_B_-_”, then a total of 4*1024=4096 pulses are added per revolution of the pulse encoder.

Position measurement can be used also if the pulse encoder is not mounted directly on the motor shaft (e.g. pulse encoder mounted on a separate measurement wheel). Parameter 50.5 SPEED FEEDB USED should than be set to ”False”, thereby not using speed measurement signal from pulse encoder (drive will then use the calculated speed signal instead). Pulse encoder signals are now used only for position measurement.

5.6.12 Field bus communication (71)

Receive

This part is used to receive signals from a superior controller via a high speed serial bus in the form of a Field Bus (e.g. Advant link, CS31 (max 8 words), Profibus (10 words), Modbus, Interbus-S, Devicenet. Please check the respective fieldbus adapter manual for limitations on the number of words possible for sending and receiving. The ACC receive signal interface is standardised as a block of 12 words where each signal has its specific position. The module also includes one element for unpacking the Command word signal to 16 Boolean signals. Updating interval for datasets 1, 3 & 5 is 32 ms, except FB SPEED REF, FB TORQ REF and FB SPEED CORR that are updated every 8 ms. For transmission of signals from drive to superior controller, see Fieldbus communication Transmit.
NOTE: If parameter 71.5 DSET BASE ADDRESS is set to 10 instead of the default value 1, than add 9 to all dataset numbers below (e.g. DS1 -> DS10, DS3 -> DS12 aso).

Table 5-4 Receive Dataset 1 (alt. 10) Word 1

FB COMMAND WORD = DataSet 1 Word 1 (signal 3.1)

Bit number	***Signal***	***Range***	***Description***
0 = Bit 0, LSB	COMTEST REC	”1” ”0”	Comtest receive bit.
1	DRIVE ON	”1” ”0” (1=active)	Drive On (magnetize) from PLC in Fieldbus mode
2	HIGH SPEED	”1” ”0” (1=active)	High speed selected (Power optimisation)
3	START OVR	”1” ”0” (1=active)	Startorder from PLC in Fieldbus mode
4	RAMP HOLD	”1” ”0” (1=active)	Speedramp hold signal
5	SEPARATE	”1” ”0” (1=active)	Separate control select signal (only in M/F ctrl)
6	TORQ CTRL SEL	”1” ”0” (1=active)	Torque control selected. (Torque ref = DS1.3)
7	LOAD MEAS SEL	”1” ”0” (1=active)	Load measurement select (enable LOAD MEAS REF)
8	RESET OVR	”0 → 1” (edge)	Reset fault from overriding control (PLC)
9	FAST STOP 1	”1” ”0” (1=active)	Fast stop type 1 (torque limit stop)
10	FAST STOP 11	”1” ”0” (1=active)	Fast stop 11 type select (see par. 63.1)
11	PGM SYNC	”0 → 1” (edge)	Program synchronisation of position measurement
12	HW SYNC INHIBIT	”1” ”0” (1=active)	Hardware (DI) sync. of pos. measurement blocked
13	RESET SYNC READY	”1” ”0” (1=active)	Reset synchronisation ready
14	USER MACRO CHANGE	”1” ”0” (0=User1)	User macro 1 or 2 change request
15 = Bit 15, MSB	ENABLE FB CTRL	”1” ”0” (1=active)	Enable fieldbus control in Stand alone Joystick mode (used by SwayControl)

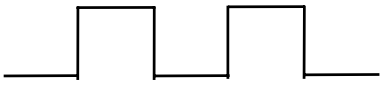
Table 5-5 Receive DataSets 1, 3, 5 and 7 (alt. 10, 12, 14 and 16)

Example: DS1.2 = DataSet 1, Word 2

DataSet.Word	***Signal***	***Range corresp. to +/- 32767***	***Description***
DS1.2 (DS10.2)	FB SPEED REF	-163.84-+163.84	Drive speed reference, % (20000=100%)
DS1.3 (DS10.3)	FB TORQ REF	-327.67-+327.67	Torque reference, % (10000=100%)
DS3.1 (DS12.1)	FB RAMP RATE	0.00-32.767 (Integer 1000 equals a rate=1.0)	Ramp rate multiplying factor for the speed ramp times set in drive, normally=1.0 (1000=1.0)
DS3.2 (DS12.2)	FB SPEED CORR	-163.84-+163.84	Speed correction signal, % (20000=100%)
DS3.3 (DS12.3)	FB POS PRECOUNT	-32767-+32767	Preset value to position counter = sync value (1=1)
DS5.1 (DS14.1)	FB AUX COMM WORD		Auxiliary Command Word (see Table 5-6 below for details)
DS5.2 (DS14.2)	FB LOAD MEAS REF	-327.67-+327.67	Load measure reference, % (10000=100%)
DS5.3 (DS14.3)	“not used”		DW signal 3.9
DS7.1 (DS16.1)	PAR VALUE 1	-32767-+32767	Parameter value for parameter selected with parameter 90.1
DS7.2 (DS16.2)	PAR VALUE 2	-32767-+32767	Parameter value for parameter selected with parameter 90.2
DS7.3 (DS16.3)	PAR VALUE 3	-32767-+32767	Parameter value for parameter selected with parameter 90.3

“SPEED” signals have scaling: 20 000 corresponds to 100 %
”TORQUE” signals have scaling: 10 000 corresponds to 100 %.

The communication is supervised continuously using a “toggle bit” received in FB STATUS WORD (DS1.1) bit 0 COMTEST REC:



If ”next edge” is not received within a certain time COMTEST FLT TD (71.1), the MAS OSC FLT fault occurs and the drive trips.

The drive is inverting the bit received from the superior controller (PLC): COMTEST REC and sending it back in FB COMMAND WORD (DS2.1) Bit 14 COMTEST TRA.

NOTE: In the superior controller the received bit should be sent to the drive again without inverting!

Table 5-6 - Receive Dataset 5 (alt. DS14) Word 1

FB AUX COMM WORD = DS5.1 (signal 3.7)

Bit number	***Signal***	***Range***	***Description***
0 = Bit 0, LSB	FB ZERO POS	”1” ”0” (1=active)	FieldBus transmitted Zero Position signal from joystick (if par. 64.10 = FB JOYSTICK)
1	FB START DIR A	”1” ”0” (1=active)	FieldBus transmitted Start Dir A signal from joystick (if par. 64.10 = FB JOYSTICK)
2	FB START DIR B	”1” ”0” (1=active)	FieldBus transmitted Start Dir B signal from joystick (if par. 64.10 = FB JOYSTICK)
3	FB JOYST TQREF SEL	”1” ”0” (1=active)	FieldBus Joystick mode Torque control enabling (if par. 64.10 = FB JOYSTICK)
4	FB ELSHAFT ON	”1” ”0” (1=active)	FieldBus Electric Shaft control On (enabled) for Master or Slave drive
5	RESTART DLOG	”0 → 1” (edge)	Restart the drive DataLoggers
6	TRIGG LOGGER	”0 → 1” (edge)	Forced trigg (stop) of the drive DataLoggers
7	DISABLE SLACKROPE	”1” ”0” (1=active)	Disable that Slack rope makes a Fast stop (stop on torque limit)

Transmit

This part is used to transmit signals from the drive to a supervisory controller via high-speed serial bus in the form of a Field Bus (e.g. Advant link, CS31 (max 8 words), Profibus (10 words), Modbus, Interbus-S, Devicenet. Please check the respective fieldbus adapter manual for limitations on the number of words possible for sending and receiving. The ACC transmit signal interface is standardised as a block of 14 words where each signal has its specific position. The module also includes elements for packing 16 Boolean signals to word signals. Updating interval for datasets 2, 4 & 12 is 32 ms, except for signals SPEED ACT and POS ACT PPU that are updated every 8 ms. Updating interval for datasets 6 & 8 is 56 ms.
Note: If parameter 71.5 DSET BASE ADDRESS is set to 10 instead of the default value 1, than add 9 to all dataset numbers below (e.g. DS2 -> DS11, DS4 -> DS13 aso).

Table 5-7 Transmit DataSet 2 (alt. DS11) Word 1

FB STATUS WORD = DataSet 2 Word 1 (signal 4.1)

Bit number	***Signal***	***Range***	***Description***
0 = Bit 0, LSB	RDY FOR ON	”1” ”0”	Ready for on
1	POWER ON ACKN	”1” ”0”	Power on acknowledgement, e.g. DI_IL
2	RDY FOR RUN	”1” ”0”	Ready for run (magnetized)
3	RUNNING	”1” ”0”	Running (producing torque)
4	ZERO SPEED	”1” ”0”	At zero speed
5	REM LOC	”1” ”0”	Remote /Local (1= Remote)
6	TORQ PROV OK	”1” ”0”	Torque proving OK
7	USER 1 OR 2	”1” ”0”	User macro 1 or 2 active
8	FAULT	”1” ”0”	Fault active
9	WARNING	”1” ”0”	Warning active
10	LIMIT	”1” ”0”	Drive in torque limit
11	SYNC	”1” ”0”	Sync input (e.g. DI3) status
12	SYNC RDY	”1” ”0”	Synchronisation ready
13	BRAKE LONG FTIME	”1” ”0”	Brake long falling time indication
14	COMTEST TRA	”1” ”0”	Communication test transmit bit
15 = Bit 15, MSB	SNAG LOAD	”1” ”0”	Snag load indication

Table 5-8 Transmit DataSets 2, 4, 6, 8 & 12 (alt. 11, 13, 15, 17 & 21)

Example: DS2.2 = DataSet 2, Word 2

DataSet.Word	***Signal***	***Range corresp. to +/- 32767***	***Description***
DS2.2 (DS11.2)	SPEED ACT (fixed)	-163.84-+163.84	Speed actual (%) (20000=100%)
DS2.3 (DS11.3)	MOTOR TORQUE FILT (fixed)	-327.67-+327.67	Torque actual (%) (10000=100%)
DS4.1 (DS13.1)	SPEED REF 3 (p92.1 to select)	-163.84-+163.84	Speed reference 3 = ramp output (%) (20000=100%)
DS4.2 (DS13.2)	POS ACT PPU (92.2)	-32767-+32767	Position actual value (1=1)
DS4.3 (DS13.3)	MOTOR CURR (92.3)	-3276.7-+3276.7	Motor current (A) (10=1A)
DS6.1 (DS15.1)	FB FAULT WORD 1 (92.4)		Application faults
DS6.2 (DS15.2)	FB FAULT WORD 2 (92.5)		Motor control faults
DS6.3 (DS15.3)	FB ALARM WORD (92.6)		Warnings
DS8.1 (DS17.1)	MOTOR VOLT (92.7)	-32767-+32767	Motor voltage (V) (1=1V)
DS8.2 (DS17.2)	DC VOLT (92.8)	-32767-+32767	DC voltage (V) (1=1V)
DS8.3 (DS17.3)	POWER (92.9)	-3276.7-+3276.7	Motor shaft power (%) (10=1%)
DS12.1 (DS21.1)	FB AUX STATUSWORD (fixed)		Aux status word
DS12.2 (DS21.2)	AI1 REF (fixed)	-163.84-+163.84	Standard analog input 1 speed reference value (%) (20000=100%)

Table 5-9 Transmit Dataset 12 (alt. DS21) Word 1

FB AUX STATUSWORD = DS12.1 (signal 4.5)

Bit number	***Signal***	***Range***	***Description***
0 = Bit 0, LSB	DIR A	"1" "0"	Stand alone direction A order
1	DIR B	"1" "0"	Stand alone direction B order
2	ZERO POS	"1" "0"	Stand alone zero position order
3	SLOWDOWN DIR A	"1" "0"	Stand alone slowdown dir A
4	SLOWDOWN DIR B	"1" "0"	Stand alone slowdown dir B
5	ELSHAFT ON ACKN	"1" "0"	Electric shaft control on acknowledge
6	BRAKE LIFT	"1" "0"	Brake lift order
7	FOLL SEP ACKN	"1" "0"	Follower Separate acknowledge
8	LOGG DATA READY	"1" "0"	Drive datalogger data ready (triggered)
9	AI3 LIMIT ACTIVE	"1" "0"	Analog input 3 speed limit is active (AI3<10mA)
10	SLACK ROPE	"1" "0"	Slack rope is detected
11	COMTEST MF	"1" "0"	Master/Follower comtest
12	FAST STOP	"1" "0"	Fast stop is active

Table 5-10 FB Fault Word 1 Dataset 6 (alt. DS15) Word 1

FB FAULT WORD 1 = Dataset 6, Word 1 (signal 4.2)

Bit number	***Signal (panel Fault text)***	***Description***
0 = Bit 0, LSB	MOT OVERSP	Motor overspeed fault
1	TORQ FLT	Torque fault
2	BRAKE FLT	Mechanical brake fault
3	ELECTR SHAFT	Electrical shaft control fault
4	TORQ PR FLT	Torque proving fault
5	MAS OSC FLT	Fieldbus "oscillator" (toggle) bit fault
6	CHOPPER FLT	Braking chopper faults
7	INV OVERLO	Inverter overload
8	EXTERNAL FLT	External fault
9	MF COMM ERR	Master/Follower bus communication fault
10	PANEL LOSS	Panel communication fault
11	I/O COMM	I/O board communication fault
12	AMBIENT TEMP	ACS800 ambient over temperature
13	THERMISTOR	Thermistor fault (DI6)
14	MF RUN FLT	Master/Follower running fault
15 = Bit 15, MSB	COMM MODULE	Comm module communication fault

Table 5-11 FB Fault Word 2 DataSet 6 (alt. DS15) Word 2

FB FAULT WORD 2 = Dataset 6, Word 2 (signal 4.3)

Bit number	***Signal (panel Fault text)***	***Description***
0 = Bit 0, LSB	DC OVERVOLT	DC-link over voltage
1	DC UNDERVOLT	DC-link under voltage
2	OVERCURRENT	Overcurrent fault
3	EARTH FAULT	Earth fault
4	MOTOR PHASE	Motor phase loss fault
5	USER MACRO	User macro requested is not saved
6	ACS 800 TEMP	Over temperature in IGBT Power plate
7	MOTOR TEMP	Motor over temperature (calculated)
8	OVERFREQ	Over frequency fault
9	START INHIBIT	Start inhibit fault (“Prevention of unexpected start” active)
10	SHORT CIRCUIT	Short circuit at output
11	PPCC LINK	Power Plate communication link fault (INT board)
12	SUPPLY PHASE	Supply phase missing (DC ripple)
13	ENCODER ERR	Encoder module / speed deviation fault
14	LINE CONV	Line converter fault (4Q drive)
15 = Bit 15, MSB	THERMAL MODE	Thermal protection mode fault (30.5)

Table 5-12 FB Alarm Word DataSet 6 (alt. DS15) Word 3

FB ALARM WORD = Dataset 6, Word 3 (signal 4.4)

Bit number	***Signal (panel Warning text)***	***Description***
0 = Bit 0, LSB	MOTOR TEMP	Motor high (95%) temperature (calculated)
1	COMM MODULE	Comm module communication alarm
2	ID RUN FAIL	ID Run failed
3	ACS 800 TEMP	High temperature in IGBT Power plate
4	ENCODER ERR	Encoder module speed deviation alarm
5	JOYSTICK	Joystick supervision alarm (Stand alone)
6	START INHIBIT	Start inhibit alarm (“Prevention of unexpected start” active)
7	“Not used”	
8	THERMISTOR	Thermistor alarm (DI6)
9	NO MOT DATA	No motor data or too low nominal current entered
10	LIFETIME>90%	Crane hoist machinery lifetime exceeded 90% of total lifetime set in par. 74.2
11	“Not used”	
12	“Not used”	
13	“Not used”	
14	“Not used”	
15 = Bit 15, MSB	“Not used”	

5.6.13 Master/Follower (72)

General

The Master/Follower is a load sharing Application and is designed for applications in which the system is run by two CraneDrives and the motor shafts are coupled to each other via gearing, rail, shaft, etc.

The Master/Follower application is then controlling the load distribution between the drives. The Master drive is sending order signals and references (speed and torque) through the Master/Follower bus to the Follower drive. The Master is also reading back status information from the Follower drive to ensure a safe operation.

The Master/Follower application can be used for both hoist and travel motions, in both Fieldbus mode and Standalone mode.

The Master station shall always be speed controlled and the Follower station normally be Torque controlled.

NOTE: Both drives must be in DTC control mode (i.e. M/F ctrl does not work in Scalar mode).
To ensure correct Follower load sharing the Follower speed limits 20.1 & 20.2 must be set 5 % higher than the setting of Master parameter 69.1 SPEED SCALING.

Checklist for a Quick Start-up

The installation and start-up procedure of the CraneDrive is explained in *ACS 800 Hardware manual.* An additional checklist for the Master/Follower application is given below:

1 Switch off the power supplies to the CraneDrive units. Wait for five minutes to ensure that the intermediate circuits are discharged.
2 Build the M/F link, Master Ch2 to Follower Ch2.

See *Figure 5-17 Master/Follower configuration in Stand Alone mode.*
NOTE: Optical fibers for Master/Follower bus to be ordered separately!

3 Connect the external control signals to the Master.

4 Switch on the power supplies.

5 Activate M/F control Macro in both CraneDrives (Parameter 99.2 Application Macro = M/F CTRL)

6A Stand Alone Mode

In the Master set parameter:
- Stand Alone Sel (Parameter 64.1) to True
- Master/Follower Mode (Parameter 72.1) to Master.

In the Follower set parameter:
- Stand Alone Sel (Parameter 64.1) to True
- Master/Follower Mode (Parameter 72.1) to Follower.
- Torque Selector (Parameter 72.2) to Torque
- Brake Int Ackn (Parameter 67.3) to True

6B Fieldbus mode
In the Master set parameter:
- Enable Comm module (Parameter 98.2)
- Stand Alone Sel (Parameter 64.1) to False
- Master/Follower Mode (Parameter 72.1) to Master.

In the Follower set parameter:
- Enable Comm module if required (Parameter 98.2)
- Stand Alone Sel (Parameter 64.1) to False
- Master/Follower Mode (Parameter 72.1) to Follower.
- Torque Selector (Parameter 72.2) to Torque
- Brake Int Ackn (Parameter 67.3) to True

7 Set all application parameters in both drives

8 Switch the CraneDrive units to external control with the LOC REM - key on the Control Panel (there should be no L on the first row of the display). Reset both drives.

9 Perform the test run with the motors still de-coupled from the driven machinery. For this test temporary set the Follower in speed control mode (Parameter 72.2 Torque Selector = Speed). Give the control signals both through the Master analogue/digital or through fieldbus inputs and from the master Control Panel.

Check the correct operation of the Master and Follower drives visually (motor & Control Panel display):
- Start and Stop signals to the Master are received by the drives.
- The Master follows the speed reference given
- The Follower follows the master speed reference.

10 The Control Panel on the Follower is not active and can not control the drive.

11 Change Follower back to Torque mode (set Parameter 72.2 = Torque)

71. Switch off the power supplies.

13 Couple the motor shafts to the driven machinery and switch on the power supplies.

Stand Alone mode

The external control signals are connected to the drive concerned. The Master controls the Follower via a fiber optic serial communication link.

NOTE: For hoist applications pulse encoder and RTAC-01 (or NTAC-02) is compulsory on both drives.

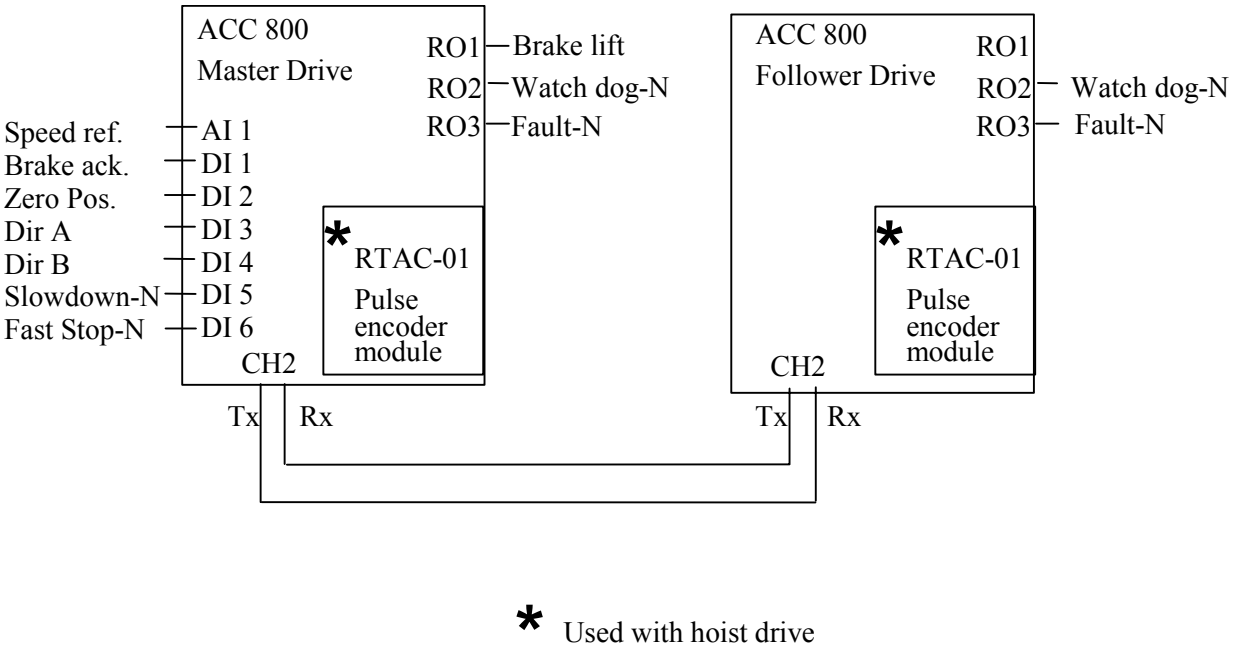


Figure 5-17 Master/Follower wiring information for Stand Alone application

Fieldbus Mode

The Master, which is controlled from the Fieldbus, controls the Follower via a fiber optic serial communication link. The external control signals are connected to the drive concerned. (DI1 - DI4)

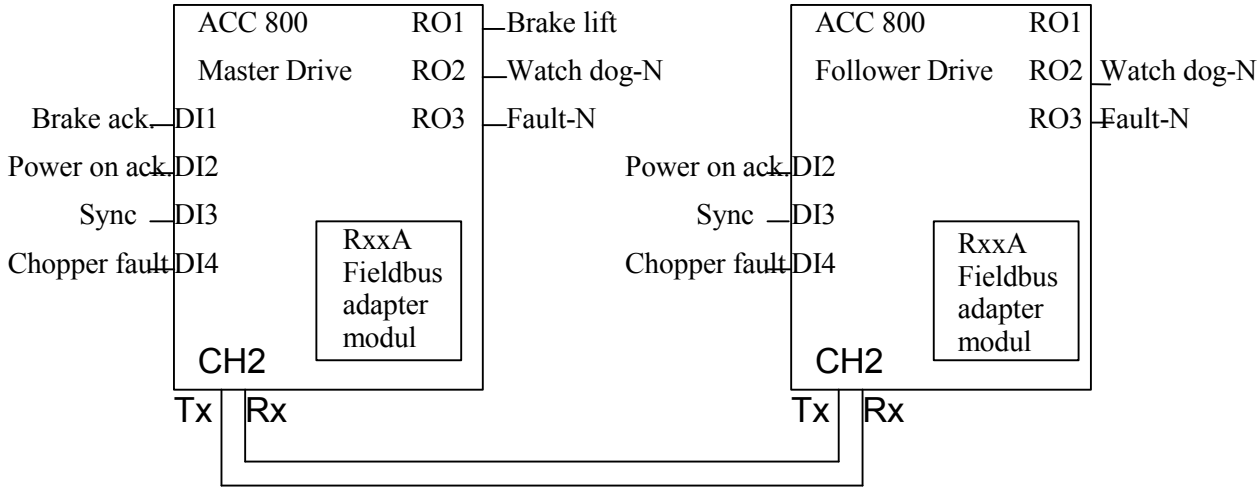


Figure 5-18 Master/Follower wiring information for Fieldbus application

Operation

Master and Follower Stations

The default settings of the Master/Follower Control macro parameters does not define the station as Master or Follower. The selection is done with parameter 72.1 MAST/FOLL MODE.

If Follower operation is selected the convertor can not be operated from the panel.

Redundancy operation

If one motion is driven by two mechanically coupled motors with separate drives in Master/Follower mode, than separate operation of Master or Follower drive can be used for redundancy operation (if one drive fails).

The drives can be run separately by User Macro 1 for normal Master/Follower operation. (Parameter 99.2 = M/F CTRL) and User Macro 2 for redundancy operation (Parameter 99.2 = CRANE).

For changeover from User Macro 1 to User Macro 2 a digital input or bit 14 in fieldbus Command word can be used (see parameter 16.5).

Brakes needs to be controlled by both drives if motors mechanically connected.

Separate operation

The signal SEPARATE in the fieldbus Command word (DS1.1 bit 5) can also be used for changing M/F drives from Master/Follower operation to normal, non-Master/Follower operation. This is available in both Stand alone and Fieldbus modes. For Follower drive there is a “separate change acknowledge” signal available in fieldbus Aux status word (DS12.1 Bit 7), see also section 5.5.12 .
NOTE: Changing of signal SEPARATE (0 to 1 or 1 to 0) can only be done if status signal RUNNING=0.

Panel separate operation

The Master and Follower drives can be operated separately from the Control Panel or DriveWindow, e.g. during maintenance, by setting parameter 72.1 MAST/FOLL MODE = OFF.

Multiple Followers

It is possible to connect more than one Follower drive in a Master/Follower configuration by activating the “Broadcast mode” (parameter 72.11=YES) in all drives. See also section 6.2.27 .
Master drive is on the Ch2 M/F bus sending the Torque and Speed references to any Follower connected. But in this mode there is no start order sent from Master to Followers. Neither is there any check of Followers status done by the Master drive. Start order and status check (e.g. any faulty Follower) must be done externally via I/O or fieldbus to all Master/Follower drives.

Master/Follower link Specification

Size of the Link: One Master and one Follower station can be connected.

Transmission medium: Fiber Optic Cable.

- Construction: Plastic core, diameter 1 mm, shielded with plastic jacket
- Attenuation: 0.31 dB/m
- Maximum length between Stations: 10 m
- Other:

Parameter	**Minimum**		**Unit**
Storage Temperature	-55	+85	^{o}C
Installation Temperature	-20	+70	^{o}C
Short Term Tensile Force		50	N
Short Term Bend Radius	25		mm
Long Term Bend Radius	35		mm
Long Term tensile Load		1	N
Flexing		1000	cycles

Various lengths of fiber optic cables are available as optional add-on kit for the CraneDrive.

Connectors on the RDCO-0x board: Blue - receiver (hp 9534, T-1521); grey – transmitter (hp 9534, R-2521)
Serial Communication Type: Synchronous, full duplex
Transmission Rate: 4 Mbit/s
Transmission Interval: 4 ms
Protocol: Distributed Drives Communication System, DDCS

5.6.14 Electric shaft (73)

The electric shaft control is used for synchronized operation of two drives. For example, two independent hoist machineries connected to the same load.
To use Electric shaft control both drives are required to have pulse encoder feedback. They are also required to have fiber optic connection between channel 2 in Master and Slave drive (RDCO-0x board needed).

Basic function is that position counter values from the Master and Slave drive are compared and the difference is controlled to zero by adding a speed correction reference (positive or negative) in Slave drive. This correction is limited to +/- 5 %. When stopping (startorder=0) the correction is disabled below a speed set in parameter 73.6 ELSH CTRL MIN SPD (but position difference is still measured and used for correction when new start order is given).
Correction P-controller is adjusted with parameter 73.2 ELSHAFT GAIN.

Electric shaft control can be used in both Stand alone and Fieldbus mode.

Electric shaft control can be switched on or off with an external signal ELSHAFT ON using a digital input, parameter 10.15 ELSHAFT ON SEL, or fieldbus Aux. command word (DS5.1:4) signal FB ELSHAFT ON. This external signal should be connected to both Master and Slave drive.

When Electric shaft control is switched on, start orders and reference are only required for Master drive. Master sends orders and reference to Slave drive via channel 2 Master/Follower bus. Ramp times in Slave must be set equal to or shorter than Master.

When Electric shaft control is switched off, both drives work as two individual “normal” drives (similar to activating “Separate” with M/F drives).

If switching Electric shaft control on or off while motors are running, drives will make a ramp stop. New start is possible after returning joystick to zero position.

When any of the Master or Slave drive receives a Slowdown limit switch indication, both drives will be limited to this slowdown speed (if Electric shaft control is active).

Power optimisation can be utilised on Electric shaft hoist drives. Both drives should have power optimisation enabled. The lower reference value calculated by Master or Slave will be used by both drives.

When using different gear box ratios for Master and Slave drive, a speed ratio between Master and Slave can be set using parameters 73.3 GEAR NUMERATOR and 73.4 GEAR DENOMINATOR (see section 6.2,28 for details).

If Master and Slave drive are set to have different 100 % speed (i.e. different setting of parameter 69.1 SPEED SCALING RPM), than parameter 70.1 POS SCALE must be adjusted accordingly in one of the drives e.g. Slave.

Example: If Slave speed scaling is 2 times Master speed scaling, than Slave Pos scale should be set 2 times Master drive Pos scale.

If electric shaft position error (signal 2.26 ELSHAFT POS ERROR) exceeds the level set in parameter 73.5 POS ERROR LIMIT, both drives will trip and the Slave indicates “ELECTR SHAFT” fault. Master will then also indicate “FOLL FAULT” (Follower fault).

Configuring the Electric shaft control:

Both drives, designated “Master” and “Slave”, are to be set up with Ch2 Master/Follower communication. This is done by selecting parameter 99.2 APPLICATION MACRO = M/F CTRL. Also fiber optic connection is required between Ch 2 in both drives.

To define communication master and slave: Set parameter 72.1 MAST/FOLL MODE = MASTER in the “Master” drive.

Set parameter 72.1 MAST/FOLL MODE = FOLLOWER and set 72.2 TORQUE SELECTOR = SPEED in the “Slave” drive.

Set parameter 73.1 ELSHAFT MODE SEL = MASTER in “Master” drive and to SLAVE in “Slave” drive.

If using drives in Stand alone mode (i.e. parameter 64.1 STANDALONE SEL = True), select what digital input is used for enabling the Electric shaft control. Set with parameter 10.15 ELSHAFT ON SEL.
Example: Selecting parameter 10.15 = EXT DI3 refers to extended NDIO module #2, digital input #1.
To be set in both “Master” and “Slave” drive.

If using Fieldbus mode (i.e. parameter 64.1 = False) or Stand alone FB Joystick mode, the enabling of Electric shaft control can also be done with bit number 4 (bit numbering 0…15) in dataset no. 5, word 1.

Other related parameters to be checked:
98.1 Encoder module = e.g. RTAC SLOT1
50.1 Encoder pulse nr
69.1 Speed scaling rpm = max. operating Speed
69.2 – 5 Acc/Dec ramp times forward and reverse
70.1 Pos scale (e.g. no. of pulses/mm)
20.1 – 2 Minimum/Maximum speed limits (to be 5% higher than parameter 69.1)
98.5 – 6 DI/O Ext modules 1 – 2 selection

5.6.15 Crane lifetime monitor (74)

The main function of the Crane lifetime monitor is to indicate how much is left of the crane hoist mechanical lifetime, signal 1.35 LIFETIME LEFT %.

This is done with the help of the following signals:
- Total operating time (= brake open time) of the drive, signal 1.32 TOTAL OPER TIME. Signal is backed up in non-volatile memory.
- Continuously calculated actual hoist load, signal 1.33 LOAD TORQUE ton.
- Load spectrum factor Km (function of load and time), signal 1.34 LOAD SPEC FACT Km. Signal is backed up in non-volatile memory.

To get a correct load signal the Inertia parameters 68.4 and 68.5 must be tuned, see tuning instruction on page 5-34 (part of commissioning power optimisation instruction).
NOTE: There is no requirement to set parameter 68.1 POWOP SELECT or 68.2 BASE SPEED in order to get the load torque signal to work.

For compensating the mechanical efficiency of hoist machinery to get equal load torque value in both hoisting and lowering direction, parameters 68.12 LOADCORR FACT UP and 68.13 LOADCORR FACT DWN should be adjusted.
These parameters are also used for scaling the motor utilization, i.e. the motor torque level (in per unit; % torque/100) when hoisting rated load.

The signal 1.33 “LOAD TORQUE ton” must to be scaled using parameter 74.1 NOMINAL LOAD.

The mechanical lifetime is set with parameter 74.3 CRANE LIFETIME.

When all settings are done the Crane lifetime calculation is started by setting parameter 74.3 START LIFETIMEMON = ON.
Note: This parameter cannot be reset with user parameters.

When the signal LIFETIME LEFT % has reached a level below 10%, the drive will give a warning: “LIFETIME>90%”.

NOTE:
To transfer the latest TOTAL OPER TIME and LOAD SPEC FACT Km signals values from an existing RMIO control board to a spare board in case of service repair, please contact ABB Service.

5.7 User Macros

User Macros allow the current parameter settings to be stored in memory. Two User Macros can be created. This can be used for Shared motion operation, i.e. two different motors using same converter via contactors.

To store your customised parameters:

1. Access the Start-up Data group as described in Table 2-6 in *Chapter 2 - Overview of CraneDrive Programming*.

2. Change Parameter 99.2 APPLICATION MACRO to USER1 SAVE or USER2 SAVE.
Note: It's recommended to keep parameter 10.17 "User macro ch srce" = NOT SEL until User macro saving is completed (10.17 is not saved in User macros).

3. Press ENTER to save.

The current settings are now stored in the User Macro. The storing will take a few minutes, please wait. The Parameter settings can be changed thereafter without loosing the settings saved to the User Macro. After power switch off, when you turn on the power again the original User Macro settings are valid. (With other Application Macros the parameter setting will be permanently saved when you press ENTER after changing the parameter value and during power up default values of the parameters are not restored.)

To recall the last saved parameters (User Macro):

1. Access the Start-up Data group as described in Table 2-6 in *Chapter 2 - Overview of CraneDrive Programming*.

2. Change Parameter 99.2 APPLICATION MACRO to USER1 LOAD or USER2 LOAD.

3. Press ENTER to load.

If there exists no User Macro is saved and you try to load one a fault indication is displayed

```
** FAULT **
USER MACRO
```

The User Macros can also be switched via digital inputs or Fieldbus; selectable with Parameter 10.17 as described in chapter 6.

The User Macro used can be changed via a digital input or Fieldbus communication (edge triggered) only after the drive is off (magnetising is off) i.e. Rdy For Run = 0. During the change the drive will not start. The acknowledgement signal USER 1 OR 2 (digital output or Fieldbus) indicates when the change is completed and the drive can be started again.

NOTE: User Macro load restores also the motor settings of Start-up Data group and the results of the Motor ID Run. Check that the settings correspond to the motor used.

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Chapter 6 - Parameters

6.1 Overview

This chapter explains the function of, and valid selections for, each CraneDrive parameter.

6.2 Parameter Groups

The CraneDrive parameters are arranged into groups by their function. Figure 6-1 illustrates the organisation of the parameter groups. *Chapter 2 – Overview of CraneDrive Programming* explains how to select and set the parameters. *Refer to Chapter 3 – Start-up Data and Chapter 4 – Control Operations* for more information on the Start-up Data and Actual Signals. Some parameters that are not in use in the current application are hidden to simplify programming.

CAUTION! Exercise caution when configuring I/O connections as it is possible to use one I/O connection to control several operations. If an I/O is programmed for some purpose the setting remains, even if you select the I/O for another purpose with another parameter.

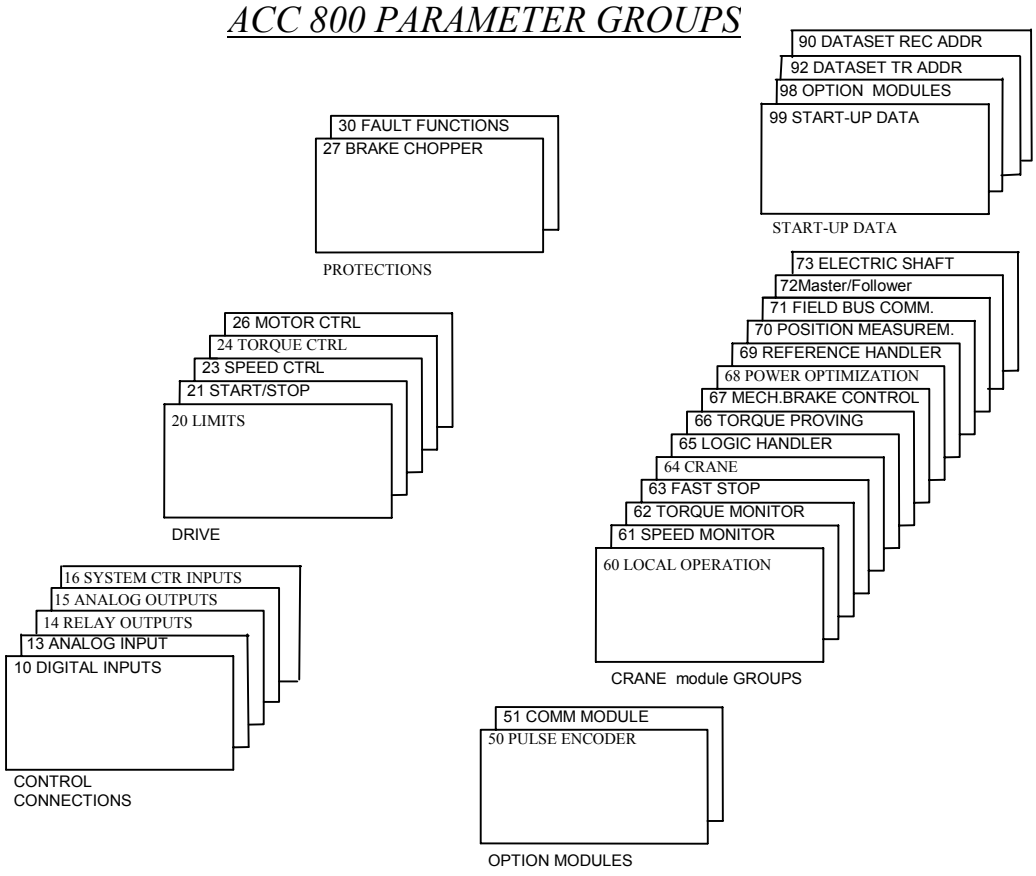


Figure 6-1 Parameter Groups

6.2.1 Group 10 Digital Inputs

These parameter values can be altered with the CraneDrive running, The Range/Unit column in Table 6-1 below shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-1 Group 10.

Parameter	Range/Unit	Description
1 BRAKE ACKN SEL	INTERNAL ACK; DI1; DI2; DI5; DI6; DI_IL	Brake acknowledge digital input
2 ZERO POS SEL	NOT SEL; DI1; DI2; DI5; DI6; DI_IL	Zero position digital input (Stand alone)
3 SLOWDOWN-N SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1 … EXT DI2.2; DI5 + DI6; DI1.1+DI1.2; DI_IL	Slowdown digital input
4 FAST STOP-N SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1 … EXT DI2.2; DI_IL	Fast stop digital input (Stand alone)
5 POWER ON ACKN SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1 … EXT DI2.2; EXT DI1.3; EXT DI2.3; DI_IL	Power-On acknowledge digital input
6 SYNC SEL.	NOT SEL; DI1 … DI6; EXT DI1.1 … EXT DI2.2; DI_IL	Synchronisation digital input
7 CHOPPER FLT-N SEL	See parameter 10.6	Chopper fault digital input
8 STEP REF2 SEL	See parameter 10. 5	Step reference 2 digital input (Stand alone)
9 STEP REF3 SEL	See parameter 10. 5	Step reference 3 digital input (Stand alone)
10 STEP REF4 SEL	See parameter 10. 5	Step reference 4 digital input (Stand alone)
11 HIGH SPEED SEL	See parameter 10. 4	High speed digital input (Stand alone)
12 SNAG LOAD-N SEL	NOT SEL; DI1 … DI6; DI_IL	Snag load digital input
13 ACCELERATE SEL	See parameter 10. 4	Accelerate digital input (Stand alone)
14 FB STOPLIM SEL	NOT SEL; DI3 + DI4; DI5+DI6; DI1.1+DI1.2	Fieldbus stop limit digital inputs
15 ELSHAFT ON SEL	NOT SEL; DI1; DI2; EXT DI1.1…EXT DI 2.2; EXT DI1.3; EXT DI2.3; DI5; DI6; DI_IL	Electric shaft control on digital input
16 FAULT RESET SEL	NOT SEL; DI1 ... DI6; DI_IL	Fault reset digital input.
17 USER MACRO CH SRCE	NOT SEL; DI1 ... DI6, COMM MOD; DI_IL	Restores parameters to user macro setting values.
18 EXTERNAL FAULT	NOT SEL; DI1-DI6; DI_IL	External fault input.

1 BRAKE ACKN SEL Selection of digital input for signal BRAKE ACKN

INTERNAL ACK; DI1; DI2; DI5; DI6; DI_IL

INTERNAL ACK (internal acknowledge) setting is used if no brake acknowledge signal is available.

2 ZERO POS SEL Selection of digital input for signal ZERO POS, used in Stand alone mode.

NOT SEL; DI1; DI2; DI5; DI6; DI_IL

3 SLOWDOWN-N SEL Selection of digital input for signal SLOWDOWN-N, used in Stand alone mode. DI5 + DI6 or DI1.1+DI1.2 selected gives SLOWDOWN DIR A-N and SLOWDOWN DIR B-N signals. DI5 + DI6 and DI1.1+DI1,2 also work in Fieldbus mode.

NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; DI5 + DI6; DI1.1+DI1.2; DI_IL

4 FAST STOP-N SEL Selection of digital input for signal FAST STOP-N, used in Stand alone mode.

NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1 … EXT DI2.2; DI_IL

5 POWER ON ACKN SEL Selection of digital input for signal POWER ON ACKN, used if separate 24Vdc supply to control unit. Connected to aux contact (NO) on Main contactor.

NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1 … EXT DI2.2; EXT DI1.3; EXT DI2.3; DI_IL

6 SYNC SEL Selection of digital input for signal SYNC, used to make Hw synchronisation of position counter.

NOT SEL; DI1 … DI6; EXT DI1.1 … EXT DI2.2; DI_IL

7 CHOPPER FLT-N SEL Selection of digital input for signal CHOPPER FLT-N, used to indicate fault in chopper unit. Wired from chopper fault contact (NO).

NOT SEL; DI1 … DI6; EXT DI1.1 … EXT DI2.2; DI_IL

8 STEP REF 2 SEL Selection of digital input for signal STEP REF 2, used in Stand alone mode, with Step Joystick or Step Radio control.

NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1 … EXT DI2.2; EXT DI1.3; EXT DI2.3; DI_IL

9 STEP REF 3 SEL Selection of digital input for signal STEP REF 3, used in Stand alone mode, with Step Joystick or Step Radio control.

NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1 … EXT DI2.2; EXT DI1.3; EXT DI2.3; DI_IL

10 STEP REF 4 SEL — Selection of digital input for signal STEP REF 4, used in Stand alone mode, with Step Joystick or Step Radio control.

NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1 … EXT DI2.2; EXT DI1.3; EXT DI2.3; DI_IL

11 HIGH SPEED SEL — Selection of digital input for signal HIGH SPEED, used in Stand alone mode, to enable Power optimising speed ref.

NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1 … EXT DI2.2; DI_IL

12 SNAG LOAD-N SEL — Selection of digital input for signal SNAG LOAD-N, used in Fieldbus mode to activate Fast stop 2 during hoisting only.

NOT SEL; DI1 … DI6; DI_IL

13 ACCELERATE SEL — Selection of digital input for signal ACCELERATE, used in Stand alone mode, with Motor Pot control.

NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1 … EXT DI2.2; DI_IL

14 FB STOPLIM SEL — Selection of digital inputs for STOPLIM A and STOPLIM B signals. Used in Fieldbus mode and Stand alone FB Joystick mode.

NOT SEL; DI3+DI4; DI5+DI6; DI1.1+DI1.2

15 ELSHAFT ON SEL — Selection of digital input for ELSHAFT ON signal, used in Electric shaft control.

NOT SEL; DI1; DI2; EXT DI1.1 … EXT DI2.2; EXT DI1.3; EXT DI2.3; DI5; DI6; DI_IL

16 FAULT RESET SEL — **NOT SEL; DI1 ... DI6; DI_IL**

If you select NOT SEL, fault reset can only be executed from the Control Panel keypad. If a digital input is selected, fault reset is executed from an external switch, if in External control mode, or from the Control Panel. Reset from a digital input is activated by opening a normally closed contact (negative edge on digital input).
Note: Reset from Fieldbus Command word is always available when in External control. Reset from Fieldbus Command word (RESET OVR) is activated on positive edge of signal.

17 USER MACRO CH SRCE **NOT SEL; DI1 ... DI6; COMM MODULE; DI_IL**

This parameter enables the selection of the desired User Macro via a digital input or Fieldbus communication in the following way:

When the state of the specified digital input or Fieldbus signal changes from high to low (on negative edge) User Macro 1 is restored. When the state of the specified digital input or Fieldbus signal changes from low to high (on positive edge) User Macro 2 is restored.

If the required User Macro does not exist a fault indication is displayed:

```
** FAULT **
USER MACRO
```

The User Macro used can be changed via a digital input or Fieldbus communication (edge triggered) only after the drive is off (magnetising is off) i.e. Rdy For Run = 0. During the change the drive will not start. The acknowledgement signal USER 1 OR 2 (digital output or Fieldbus) indicates when the change is completed and the drive can be started again.

18 EXTERNAL FAULT **NOT SEL**

No input for External fault trip & indication selected.

DI1-DI6, DI_IL

This selection defines the digital input used for an external fault signal. If an external fault occurs, i.e. digital input drops to 0 VDC, the CraneDrive stops.

6.2.2 Group 13 Analogue Inputs

These parameter values can be altered with the CraneDrive running, The Range/Unit column in Table 6-2 below shows the allowable parameter values. The text following the table explains the parameters in detail.

NOTE: Updating interval for AI1 and AI2 is 32 ms, and for EXT AI1 (Speed correction) the updating interval is 8 ms.

Table 6-2 Group 13.

Parameter	Range/Unit	Description
1 SCALE AI1	0 ... 4.000	Scaling factor for AI1
2 FILTER AI1	0 s ... 4.00 s	Filter time constant for AI1.
3 SCALE AI2	0 ... 4.000	Scaling factor for AI2
4 FILTER AI2	0 s ... 4.00 s	Filter time constant for AI12
5 SCALE EXT AI1	0 ... 4.000	Scaling factor for EXT AI1 (RAIO)
6 FILTER EXT AI1	0 s ... 4.00 s	Filter time constant for EXT AI1 (RAIO)
7 AI1 0% REF LEV	0.0 ... 10.0 V	AI1 signal level corresponding to 0% speed reference

1 SCALE AI1 Scaling factor for analogue input AI1 signal.

2 FILTER AI1 Filter time constant for analogue input AI1

As the analogue input value changes, 63 % of the change takes place within the time specified by this parameter. If you select 0 sec. that equals the minimum value, the signal is filtered with a time constant of 10 ms.

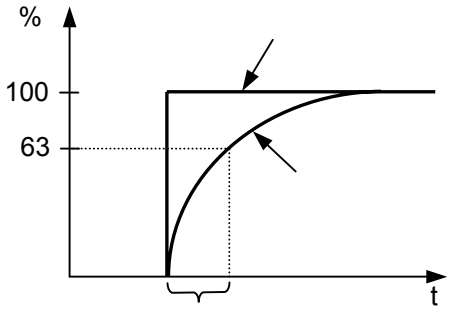


Figure 6-2 shows the filter time constant.

3 SCALE AI2 Refer to parameter 13.1.

4 FILTER AI2 Refer to parameter 13.2.

5 SCALE EXT AI1 Refer to parameter 13.1.

6 FILTER EXT AI1	Refer to parameter 13.2.
7 AI1 0% REF LEV	The minimum AI1 voltage level that should correspond to 0 % speed reference is adjustable with this parameter. Can for example be used if a 4-20 mA reference signal is connected to AI1 (with 500 ohm resistor across AI1 input giving a 2-10V signal). Parameter is than set equal to 2.0 V. Input signal range of 2 -10 V than gives the 0 - 100 % speed reference with a linear relation (e.g. 6V=50%). Any voltage on input AI1 below the level set in parameter gives 0 % speed reference.

6.2.3 Group 14 Relay Outputs

The text following Table 6-3 below explains the parameters in detail.
NOTE: Updating interval for Relay outputs is 32 ms.

Table 6-3 Group 14.

Parameter	Range/Unit	Description
1 RELAY RO1 OUTPUT	Refer to the text below for the available selections.	Relay output 1 content.
2 RELAY RO2 OUTPUT		Relay output 2 content.
3 RELAY RO3 OUTPUT		Relay output 3 content.
4 EXT1 DO1 OUTPUT		#1 RDIO, DO1 content
5 EXT1 DO2 OUTPUT		#1 RDIO, DO2 content
6 EXT2 DO1 OUTPUT		#2 RDIO, DO1 content
7 EXT2 DO2 OUTPUT		#2 RDIO, DO2 content

1 RELAY RO1 OUTPUT This parameter allows you to select which information is indicated with relay output 1.

NOT USED

READY

The CraneDrive is ready for ON-order. The relay is not energized if: the “Power On Ackn” signal (e.g. DI2) is not present, or DC bus voltage is not OK, or “Prevention of unexpected start” circuit is open (Multidrive) or a fault exists.

RUNNING

The CraneDrive has been started with speed and torque controllers active.

FAULT

A fault has occurred. Refer to *Chapter 7– Fault Tracing* for more details.

FAULT-N

Relay energized when power is applied, and de-energized upon a fault trip.

CONTROL LOC

Control location. Indication if External or Local control mode is selected from panel. CONTROL LOC = False indicates Local control mode (panel control).

BRAKE LIFT

Signal for controlling the mechanical brake.

WATCHDOG-N

Indicates: Communication supervision (MAS OSC FLT or MF COMM ERR), Braking chopper faults (CHOPPER FLT, BC OVERHEAT, BC SHORT CIR or BR OVERHEAT), External fault (EXT FAULT) and Brake long falltime (BRAKE LONG FTIME) of the brake. Also indicating if CPU Stalls out. **This signal should be used to give Emergency Stop to crane drive.**
NOTE: Fieldbus communication supervision (MAS OSC FLT) only available in Fieldbus mode or Standalone FB Joystick mode.

USER 1 OR 2

Indicates if User Macro 1 is loaded (=0), or if User Macro 2 is loaded (=1).

REVERSE

Indicates if motor speed is negative.

OVERSPEED

Fault signal indication for motor overspeed trip (level set with parameter 61.3)

RDY FOR RUN

Indicates that motor is magnetized (ON) and ready for a start order.

SPEED LIM 1

Activated if absolute value of motor speed is above level set in parameter 61.4 SPEED LIM 1.

LIFETIME>90%

Activated if the Crane lifetime monitor signal 1.35 LIFETIME LEFT % is below 10% (percent of parameter 74.2 CRANE LIFETIME).

2 RELAY RO2 OUTPUT	Refer to Parameter 14.1 RELAY RO1 OUTPUT.
3 RELAY RO3 OUTPUT	Refer to Parameter 14.1 RELAY RO1 OUTPUT.
4 EXT1 DO1 OUTPUT	Refer to Parameter 14.1 RELAY RO1 OUTPUT.
5 EXT1 DO2 OUTPUT	Refer to Parameter 14.1 RELAY RO1 OUTPUT.
6 EXT2 DO1 OUTPUT	Refer to Parameter 14.1 RELAY RO1 OUTPUT.
7 EXT2 DO2 OUTPUT	Refer to Parameter 14.1 RELAY RO1 OUTPUT.

6.2.4 Group 15 Analogue Outputs

These parameter values can be altered with the CraneDrive running. The Range/Unit column in Table 6-4 below shows the allowable parameter values. The text following the table explains the parameters in detail.
NOTE: Updating interval for Analogue outputs is 32 ms.

Table 6-4 Group 15.

Parameter	*Range/Unit*	*Description*
1 ANALOGUE OUTPUT 1	Refer to the text below for the available selections.	Analogue output 1 content.
2 INVERT AO1	NO; YES	Analogue output signal 1 inversion.
3 MINIMUM AO1	0 mA; 4 mA	Analogue output signal 1 minimum.
4 FILTER AO1	0.00 s ... 10.00 s	Filter time constant for AO1.
5 SCALE AO1	10 % ... 1000 %	Analogue output signal 1 scaling factor.
6 ANALOGUE OUTPUT 2	Refer to the text below for the available selections.	Analogue output 2 content.
7 INVERT AO2	NO; YES	Analogue output signal 2 inversion.
8 MINIMUM AO2	0 mA; 4 mA	Analogue output signal 2 minimum.
9 FILTER AO2	0.00 s ... 10.00 s	Filter time constant for AO2.
10 SCALE AO2	10 % ... 1000 %	Analogue output signal 2 scaling factor

1 ANALOGUE OUTPUT 1

This parameter allows you to select which output signal is connected to analogue output AO1 (current signal). The following list shows the full scale value with Parameter 15.5 SCALE AO1 set to 100 %.

NOT USED

MEAS SPEED

Measured (RTAC module) speed of the motor. 0mA = - 100 % motor maximum speed (Parameters 20.1 & 20.2), 10 mA = 0 % speed, 20 mA = + 100 % motor maximum speed.

SPEED

Motor speed. 20 mA = 100 % of motor nominal speed, absolute value.

FREQUENCY

Output frequency. 20 mA = motor nominal frequency.

CURRENT

Output current. 20 mA = motor nominal current.

SIGN TORQUE

Motor torque with sign. 0 mA = TORQUE REF SCALE (Par 64.9) * -100 % of motor nominal rating, 10 mA = 0 % torque, 20 mA = TORQUE REF SCALE * +100% of motor nominal rating.

POWER

Motor power. 20 mA = 100 % of motor nominal rating, absolute value.

DC BUS VOLT

DC bus voltage. 20 mA = 100 % of maximal nominal DC bus voltage. Max nominal DC = 675V if 500V unit and 560V if 400V unit.

OUTPUT VOLT

Motor voltage. 20 mA = motor rated voltage.

SIGN POSACT

Position counter (RTAC) measurement value (see signal 2.18) with sign. 0mA = - 32767 units (scaling with parameter 70.1), 10 mA = 0 units, 20 mA = + 32767 units.

SIGN SP REF

Speed reference (Speed ref3 = output from ramp) with sign. 0mA = - 100 % of motor maximum speed (par. 20.1 & 20.2), 10 mA = 0 % speed, 20 mA = + 100 % of motor maximum speed.

2 INVERT AO1 If you select YES, the analogue output AO1 signal is inverted.

3 MINIMUM AO1 The minimum value of the analogue output signal can be set to either 0 mA or 4 mA.

4 FILTER ON AO1 Filter time constant for analogue output AO1.
As the analogue output value changes, 63 % of the change takes place within the time period specified by this parameter. If you select the minimum value 0 s, the signal is not filtered (See Figure 6-2, page 6-6).

5 SCALE AO1 This parameter is the scaling factor for the analogue output AO1 signal. If the selected value is 100 %, the nominal value of the output signal corresponds to 20 mA. If the maximum is less than full scale, increase the value of this parameter.

6 ANALOGUE OUTPUT 2

This parameter allows you to select which output signal is connected to analogue output AO2 (current signal). The following list shows the full scale value with Parameters 15.10 SCALE AO2 set to 100 %.

NOT USED

SIGN SPEED

Motor speed with sign. 0mA = - 100 % motor maximum speed (par. 20.1 & 20.2), 10 mA = 0 % speed, 20 mA = + 100 % motor maximum speed.

SPEED

Motor speed. 20 mA = 100 % of motor **nominal** speed, absolute value.

FREQUENCY

Output frequency. 20 mA = motor nominal frequency.

CURRENT

Output current. 20 mA = motor nominal current

TORQUE

Motor torque. 20 mA = 100% of motor nominal rating. Absolute value.

POWER

Motor power. 20 mA = 100 % of motor nominal rating, absolute value.

DC BUS VOLT

DC bus voltage. 20 mA = 100 % of maximal nominal DC bus voltage (see also parameter 15.1).

OUTPUT VOLT

Motor voltage. 20 mA = motor rated voltage.

TORQUE REF
Torque reference used by torque controller. 20 mA = 100 % of motor nominal torque, absolute value.

SIGN SP REF
Speed reference (Speed ref3 = output from ramp) with sign. 0mA = - 100 % of motor maximum speed (par. 20.1 & 20.2), 10 mA = 0 % speed, 20 mA = + 100 % of motor maximum speed.

7 INVERT AO2 Refer to Parameter 15.2.

8 MINIMUM AO2 Refer to Parameter 15.3.

9 FILTER ON AO2 Refer to Parameter 15.4.

10 SCALE AO2 Refer to Parameter 15.5.

6.2.5 Group 16 System Ctr Inputs

The Range/Unit column in Table 6-5 below shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-5 Group 16

Parameter	*Range/Unit*	*Description*
2 PARAMETER LOCK	OPEN; LOCKED	Parameter lock input.
3 PASS CODE	0 ... 30 000	Parameter lock pass code.
8 FAN SPD CTRL MODE	CONST 50HZ; RUN/STOP; CONTROLLED	Fan speed control mode
9 FUSE SWITCH CNTR	OFF; ON	Fuse switch control
10 INT CONFIG USER	1 … 12	Inverter module configuration

2 PARAMETER LOCK This parameter selects the state of the Parameter Lock. With Parameter Lock you can inhibit unauthorised parameter changes.

OPEN

Parameter Lock is open. Parameters can be altered.

LOCKED

Parameter Lock is closed from the Control Panel. Parameters cannot be altered. Only entering the valid code at Parameter 16.3 PASS CODE can open the Parameter Lock.
Note: This function is not available if User macros are used.

3 PASS CODE This parameter selects the Pass Code for the Parameter Lock. The default value of this parameter is 0. In order to open the Parameter Lock change the value to 358. After the Parameter Lock is opened the value is automatically changed back to 0.

8 FAN SPD CTRL MODE Selection of control mode for the optional speed control of the inverter fan in ACS800 Multidrive.

CONST 50HZ

No fan speed control active. Fan is always running with constant nominal 50 or 60 Hz speed.

RUN/STOP

Fan is running with constant nominal speed when inverter is modulating and inverter temperature is above min limit.

CONTROLLED

Fan speed is controlled between 30 and 110% of nominal depending on inverter temperature.

9 FUSE SWITCH CNTR Activation parameter for optional inverter DC fuse switch.

OFF

Charging logic for DC fuse switch control is disabled. Parameter must be selected to OFF if no DC fuse switch is installed.

ON

Charging logic for DC fuse switch control is active. To be selected ON if an optional DC switch is installed.

10 INT CONFIG USER Adjustable inverter module configuration for n*R8i size inverters. This parameter is user acceptance for Reduced Run (i.e. running with reduced power) function and the number must correspond to the active inverter configuration (number of connected modules) when there are R8i inverter modules removed, e.g. for service. If active inverter configuration is the same as original factory setup than this parameter has no meaning.

6.2.6 Group 20 Limits

These parameter values can be altered with the CraneDrive running. The Range/Unit column in Table 6-6 below shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-6 Group 20.

Parameter	Range/Unit	Description
1 MINIMUM SPEED -	-18 000/(number of pole pairs) rpm … MAXIMUM SPEED (value of par. 20.2).	Operating range minimum speed. Cannot be used in the SCALAR mode(see page 3-9).
2 MAXIMUM SPEED -	MINIMUM SPEED (value of par. 20.1) ... 18 000/(number of pole pairs) rpm	Operating range maximum speed. Cannot be used in the SCALAR mode.
3 MAXIMUM CURRENT A	0.00 Amp ... *Imax* Amp	Maximum output current.
4 MAXIMUM TORQUE	0.0 % ... 600.0 %	Maximum positive output torque.
5 MINIMUM TORQUE	-600.0 % … 0.0 %	Maximum negative output torque.
6 OVERVOLTAGE CTRL	ON; OFF	DC over voltage controller
7 UNDERVOLTAGE CTRL	ON; OFF	DC undervoltage controller
8 MINIMUM FREQ	- 300.00 Hz ... MAXIMUM FREQ (value of par. 20.9)	Operating range minimum frequency. Visible in the SCALAR mode only
9 MAXIMUM FREQ	MINIMUM FREQ (value of par. 20.8) ... 300.00 Hz	Operating range maximum frequency. Visible in the SCALAR mode only
10 SPEED LIMIT AI3	0.0 % … 100.0 %	Speed limit AI3 activated
11 P MOTORING LIM	0.0 % … 600.0 %	Maximum motoring output power
12 P GENERATING LIM	-600.0 % … 0.0%	Maximum generating output power
13 TORQ RISE T LIM	0 … “max” %/ms	Torque risetime limit

1 MINIMUM SPEED Limitation of the minimum speed reference to speed controller. The default value depends on the selected motor and it is either -750, -1000, -1500 or -3000 rpm.

WARNING: If this value is set positive the motor can not decelerate to zero speed and stop when removing start-order!
This limit cannot be set in the SCALAR control mode.

2 MAXIMUM SPEED

Limitation of the maximum speed reference to speed controller. The default value depends on the selected motor and it is either 750, 1000, 1500 or 3000 rpm.

WARNING: If this value is set negative the motor can not decelerate to zero speed and stop when removing start-order!
This limit cannot be set in the SCALAR control mode.

MAXIMUM CURRENT A The maximum output current, in Amps, that the CraneDrive will supply to the motor. The default value is the **"Imax"** current rating of the ACS800 CraneDrive. For ACS600 Multidrive inverters the default value is two times the catalogue value "200% Cycle load" base rating: "$I_{AC\ 50/60s}$".

4 MAXIMUM TORQUE

This setting defines the momentarily allowed maximum positive torque of the motor. The motor control software of the CraneDrive limits the setting range of the maximum torque according to the inverter and motor data. The default value is 200 % of the nominal torque of the motor.

This limit has no function in the Scalar control mode.

5 MINIMUM TORQUE

This setting defines the momentarily allowed maximum negative torque of the motor. The motor control software of the CraneDrive limits the setting range of the maximum torque according to the inverter and motor data. The default value is -200 % of the nominal torque of the motor.

This limit has no function in the Scalar control mode.

6 OVERVOLTAGE CTRL

This parameter deactivates the DC over voltage controller.

The DC over voltage controller increases (if pos. speed) the torque if the DC bus voltage exceeds the limit - typically due to motor working in generator mode - to prevent an over voltage trip. **Note: Controller should be deactivated if using braking chopper.**

7 UNDERVOLTAGE CTRL

This parameter allows you to deactivate the undervoltage controller.

If the DC bus voltage drops due to loss of input power, the undervoltage controller will decrease the motor speed in order to keep the DC bus voltage above the lower limit. By decreasing the motor speed, the inertia of the load will cause regeneration back into the CraneDrive, keeping the DC bus charged, and preventing an undervoltage trip. This will increase power loss ride through on systems with a high inertia, such as a centrifuge or fan.

8 MINIMUM FREQ

Limitation of the minimum frequency reference used.
Warning: If this value is set positive the motor can not decelerate to zero speed and stop when removing start-order!
This limit can be set in the SCALAR control mode only.

9 MAXIMUM FREQ

Limitation of the maximum frequency reference used.
Warning: If this value is set negative the motor can not decelerate to zero speed and stop when removing start-order!
This limit can be set in the SCALAR control mode only.

10 SPEED LIMIT AI3	The speed reference to the drive is limited to the set value if analog input 3 input current is below 10 mA. If AI3 input current is above 10 mA, there is no speed limitation active (100% allowed). 100% is equal to the rpm set in parameter 69.1 SPEED SCALING RPM. The function is available in both Stand alone and Fieldbus mode.
11 P MOTORING LIM	This parameter defines the momentarily allowed maximum power fed by the inverter to the motor. The value is in percent of the motor nominal power.
12 P GENERATING LIM	This parameter defines the momentarily allowed maximum power fed by the motor to the inverter. The value is in percent of the motor nominal power.
13 TORQ RISE T LIM	This parameter is used to limit the maximum allowed torque reference change per millisecond. Output of the limitation is 2.14 TORQ USED REF. Default (=maximum) value depends on the inverter and motor size combination. **NOTE:** Motor data in group99 must be set before accessing this parameter.

6.2.7 Group 21 Start/Stop

The Range/Unit column in Table 6-7 below shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-7 Group 21.

Parameter	*Range/Unit*	*Description*
1 START FUNCTION	CNST DCMAGN	Conditions during motor ON-order.
2 CONST MAGN TIME	30 ms ... 10000 ms	Duration of pre–magnetising

1 START FUNCTION **CNST DC MAGN**

This parameter cannot be altered. Sets the constant magnetising mode.
This is the fastest starting method if the motor is at a standstill.

The CraneDrive can provide full starting torque by pre-magnetising the motor. The optimal magnetising current is calculated on the basis of the parameters concerning the motor. The pre-magnetising time is defined by Parameter 21.2 CONST MAGN TIME

Note: This mode is always used with the ACC 800 Crane Control Software.

2 CONST MAGN TIME Defines the duration of the pre-magnetising in the constant magnetising mode.
An approximate value for this can be calculated as the motor nominal power in kW multiplied by 4.
Example:
For a 100 kW motor, set parameter 21.2 CONST MAGN TIME = 4 * 100 = 400 ms.

6.2.8 Group 23 Speed Ctrl

These parameter values can be altered with the CraneDrive running. The Range/Unit column in Table 6-8 shows the allowable parameter values. The text following the table explains the parameters in detail.
These parameters are not visible in the SCALAR control mode.

Table 6-8 Group 23.

Parameter	***Range/Unit***	***Description***
1 GAIN	0.0 ... 100.0	Gain for speed controller. ***Typical value for cranes = 15.***
2 INTEGRATION TIME	0.01 s ... 999.98 s	Integration time for speed controller. ***Typical value for cranes = 0.2 - 0.5 sec.***
3 DERIVATION TIME	0.0 ms ... 9999.8 ms	Derivation time for speed controller.
4 ACC COMPENSATION	0.00 s ... 100.00 s	Derivation time used in compensation of acceleration. ***Note: Set to zero after ID Run***
5 SLIP GAIN	0.0% ... 400.0%	Gain for the slip of the motor.
6 AUTOTUNE RUN	NO; YES	Autotuning of the speed controller.
7 FEEDB FILTER TIME	0 ms … 100 ms	Filter time for actual speed
8 SPEED STEP	-1500.00 rpm … 1500.00 rpm	Speed step input for DrivesWindow step gen.

It is possible to tune the PID algorithm based speed controller of the CraneDrive by setting Parameters 1 to 5 in this group or by selecting the Autotune run by Parameter 6.

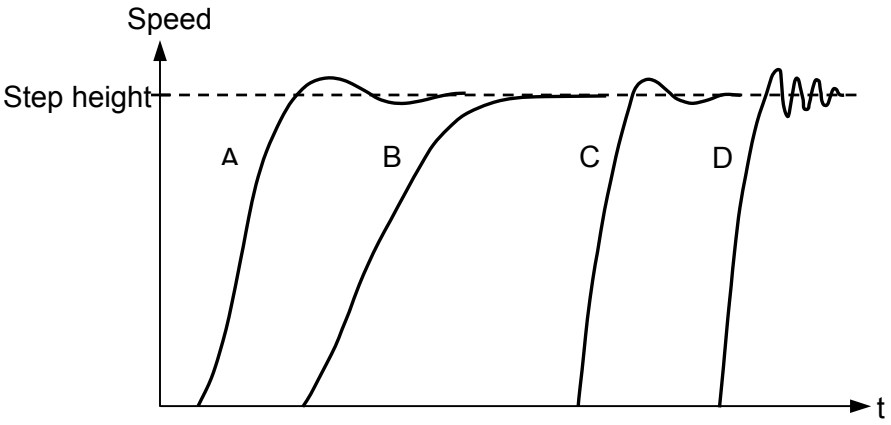
The values of these parameters define how the output of the Speed Controller changes when there is a difference (error value) between the actual speed and the reference. Figure 6-3 displays typical step responses of the Speed Controller.

Step responses can be seen by monitoring Actual Signal 1.1 SPEED ESTIMATED.

NOTE*:* The Standard Motor ID Run (refer to *Chapter 3 - Start-up data*) updates the values of Parameters 23.1, 23.2 and 23.4.
Parameter 23.1 is set = 15, 23.2 is set = 0.5 sec and 23.4 is reset to 0.0 sec after ID Run by ACC application sw.

The dynamic performance of the speed control at low speeds can be improved by increasing the relative gain and decreasing the integration time.

Speed controller output is the reference for the torque controller. The torque reference is limited by Parameters 20.4 MAXIMUM TORQUE and 20.5 MINIMUM TORQUE



A: Undercompensated: 23.2 INTEGRATION TIME too short and 23.1 GAIN too low
B: Normally tuned, autotuning
C: Normally tuned, manual tuning. Better dynamic performance than with B
EGRATION TIME too short and 23.1 GAIN too high

Figure 6-3 Step responses of the Speed Controller with different settings. 1 to 10 % reference step is used.

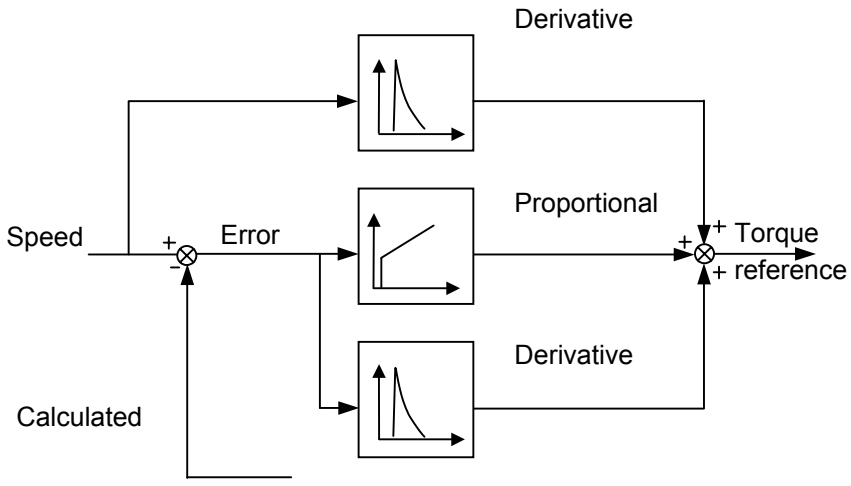


Figure 6-4 Speed controller, a simplified block diagram.

1 GAIN Relative gain for the speed controller. If you select 1, a 10 % change in error value (e.g. reference - actual value) causes the speed controller output to change by 10 % of the nominal torque

Note: Too high gain causes speed oscillation**.**

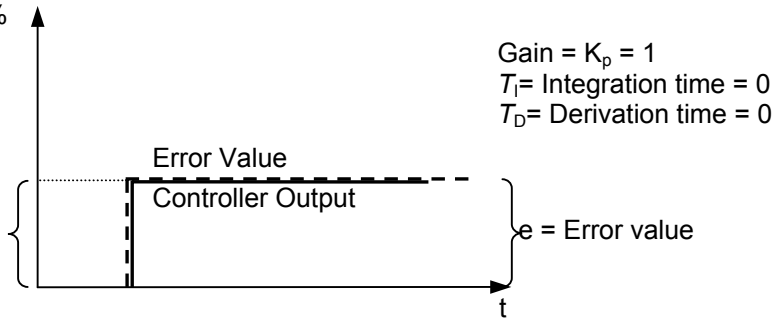


Figure 6-5 Speed Controller output after an error step when the error remains constant

2 INTEGRATION TIME Integration time defines the rate at which the controller output changes when the error value is constant. The shorter the integration time, the faster the continuous error value is corrected. Too short integration time makes the control unstable.

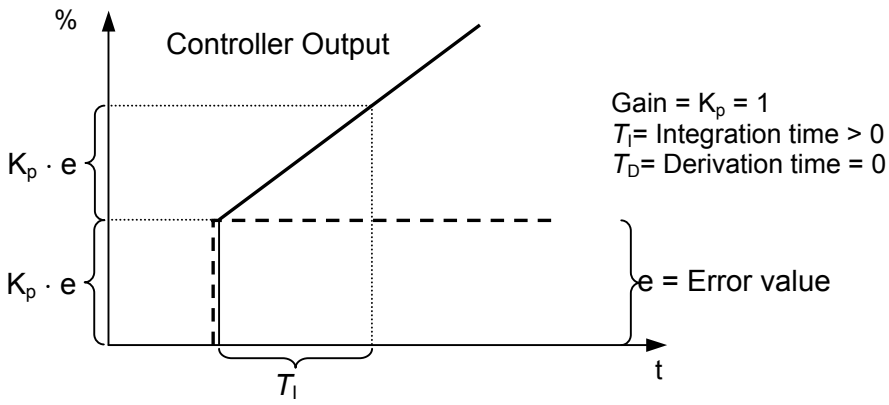


Figure 6-6 Speed Controller Output after an error step when the error remains constant.

3 DERIVATION TIME

Derivative action boosts the controller output if the error value changes. The longer the derivation time, the more the speed controller output is boosted during the change. The derivation makes the control more responsive for the disturbances. If derivation time is set to zero, the controller works as a PI controller, otherwise as a PID controller.

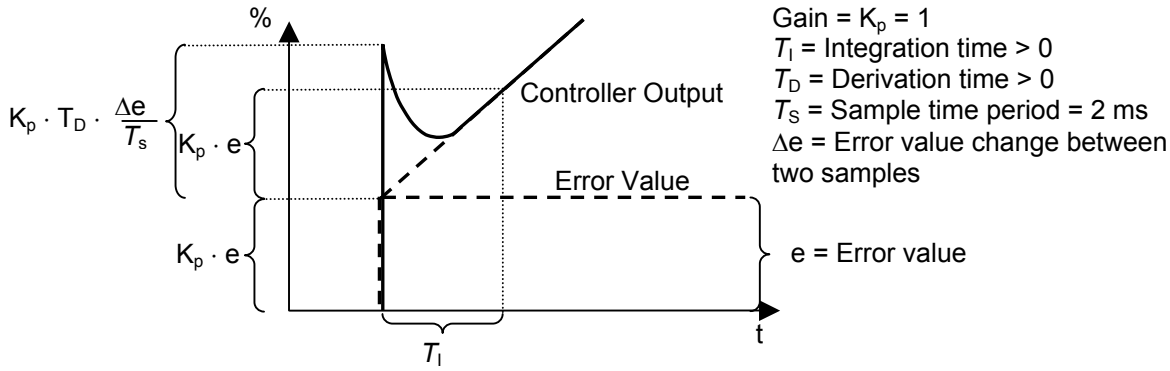

%
$K_p \cdot T_D \cdot \frac{\Delta e}{T_s}$
$K_p \cdot e$
$K_p \cdot e$
Controller Output
Error Value
e = Error value
T_I
t
Gain = K_p = 1
T_I = Integration time > 0
T_D = Derivation time > 0
T_S = Sample time period = 2 ms
Δe = Error value change between two samples

Figure 6-7 Speed Controller Output after an error step when the error remains constant

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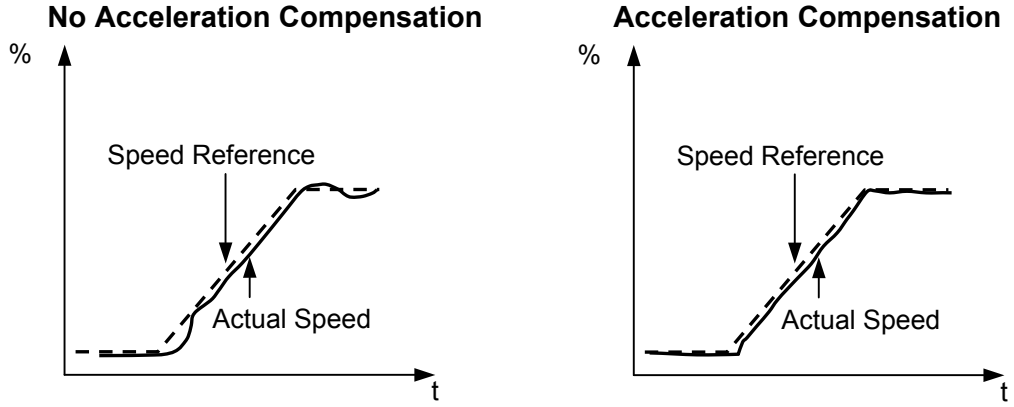
NOTE: Changing this parameter is recommended only if a pulse encoder is used.

---

4 ACC COMPENSATION

Derivation time for compensation of acceleration. In order to compensate inertia during acceleration the derivative of the reference is added to the output of the speed controller. The principle of a derivative action is described in section 3 DERIVATION TIME above.

As a general rule, set this parameter to a value from 50 to 100 % of the sum of the mechanical time constants of the motor and the driven machine.



5 SLIP GAIN

Defines the gain for the slip. 100 % means full slip compensation; 0 % means no slip compensation. The default value is 100 %. Other values can be used if static speed error is detected despite of the full slip compensation.

Example: 1000 rpm constant speed reference is given to the drive. Despite of the full slip compensation (SLIP GAIN = 100 %) a manual tachometer measurement from the motor axis gives speed value 998 rpm. The static speed error is 1000 rpm - 998 rpm = 2 rpm. To compensate the error, the slip gain should be increased. At 106 % gain value no static speed error exists.

6 AUTOTUNE RUN

The speed controller of the ACS 800 can be tuned automatically by performing the Autotune Run. The mechanical inertia of the load is taken into consideration in GAIN, INTEGRATION, DERIVATION and ACC COMPENSATION parameters. The system is tuned to be undercompensated rather than overcompensated.

To perform the Autotune Run:
• Run the motor at a constant speed of 20 to 70 % of the rated speed.
• Change Parameter 23.6 AUTOTUNE RUN to YES.
After the Autotune Run is performed, this parameter value automatically reverts to NO.

NOTE: Autotune Run can be performed only while the CraneDrive is running. The motor load must be connected to the motor. The best result is achieved when the motor is run up to 20 ... 40 % of the rated speed before starting the autotune run.

CAUTION! The motor will be accelerated by 10 % of the rated speed with 10 ... 20 % torque step without any ramp during this procedure. BE SURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE AUTOTUNING!

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7 FEEDB FILTER TIME

Filter time constant for the actual speed signal used. That is, normally the estimated speed signal, or if Encoder module (RTAC or NTAC-02) is enabled the measured speed signal from pulse encoder. If not using encoder measured speed (using estimated speed), typical filter time settings to use are 0 – 2 ms (parameter default = 4 ms).

8 SPEED STEP

Speed reference step input (without ramp). Only to be used with DrivesWindow step test generator.

6.2.9 Group 24 Torque Ctrl

These parameter values can be altered with the CraneDrive running. The Range/Unit column in Table 6-9 below shows the allowable parameter values. The text following the table explains the parameters in detail.
These parameters are not visible in Follower drive (with M/F CTRL macro).

Table 6-9 Group 24.

Parameter	*Range/Unit*	*Description*
1 TORQ RAMP UP	0.00 s ... 120.00 s	Time for reference from 0 to the rated torque.
2 TORQ RAMP DOWN	0.00 s ... 120.00 s	Time for reference from the rated torque to 0.
3 TORQ STEP	-300.00 % … 300.00 %	Torque step input for DrivesWindow step gen.

1 TORQ RAMP UP Defines the time required for the reference to increase from zero to the rated torque.

2 TORQ RAMP DOWN Defines the time required for the reference to decrease from the rated torque to zero.

Note: These parameters do not effect the torque reference sent from master to follower drive in Master/Follower control mode (using Master/Follower bus).

3 TORQ STEP Torque reference step input (without ramp). Only to be used with DrivesWindow step test generator

6.2.10 Group 26 Motor Control (visible only in SCALAR mode)

The Range/Unit column in Table 6-10 below shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-10 Group 26.

Parameter	Range/Unit	Description
3 IR COMPENSATION	0 % ... 30 %	Compensation voltage level. (Visible only in SCALAR mode.)

3 IR COMPENSATION

This parameter is adjustable in the SCALAR control mode only. This parameter sets the extra relative voltage level that is given to the motor at zero frequency. The range is 0 ... 30 % of motor nominal voltage.

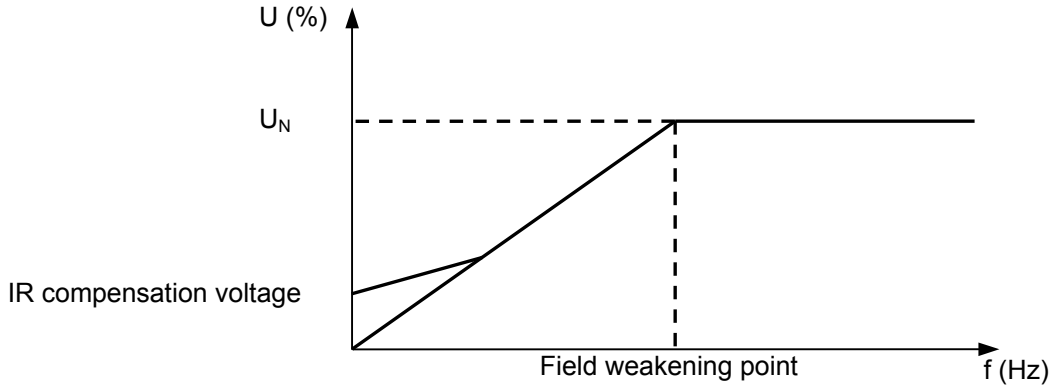


Figure 6-8 IR Compensation is implemented by applying extra voltage to the motor. a percentage of motor voltage. U_{max} maximum output voltage of the CraneDrive.

6.2.11 Group 27 Brake Chopper

The Range/Unit column in Table 6-10 below shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-11 Group 27.

Parameter	*Range/Unit*	*Description*
1 BRAKE CHOPPER	OFF; ON	Brake chopper control
2 BR OVERLOAD FUNC	NO; WARNING; FAULT	Brake resistor overload function
3 BR RESISTANCE	0.00 … 100.00 ohm	Brake resistor resistance value
4 BR THERM TCONST	0.000 … 10000.000 s	Brake resistor time constant
5 MAX CONT BR POWER	0.00 … 10000.00 kW	Maximum continuous brake resistor power
6 BC CTRL MODE	AS GENERATOR; COMMON DC	Brake chopper control mode

1 BRAKE CHOPPER Activates the brake chopper control.

OFF

Brake chopper control is inactive.

ON

Brake chopper control is active. **NOTE**: Ensure that the brake chopper and resistor are installed and the overvoltage control is switched off (parameter 20.6)

2 BR OVERLOAD FUNC Activates the overload protection of the brake resistor. The user-adjustable variables are parameters 27.03, 27.04 and 27.05.

NO

Overload protection is inactive.

WARNING

Overload protection is active. If the drive detects an overload, it generates a warning.

FAULT

Overload protection is active. If the drive detects an overload, it trips on a fault.

3 BR RESISTANCE Defines the resistance value of the brake resistor. The value is used in the overload protection. See parameter 27.02 .

4 BR THERM TCONST — Defines the thermal time constant of the brake resistor. The value is used in the overload protection. See parameter 27.02 .

5 MAX CONT BR POWER — Defines the maximum continuous braking power which will raise the resistor temperature to the maximum allowed value. The value is used in the overload protection. See parameter 27.02 .

6 BC CTRL MODE — Brake chopper control mode.

AS GENERATOR

Chopper operation is allowed when the DC voltage exceeds the braking limit, the inverter bridge modulates and motor generates power to the drive. The selection prevents the operation in case the intermediate circuit DC voltage rises due to abnormally high supply voltage level. Long term supply voltage rise would damage the chopper.

COMMON DC

Chopper operation is allowed always when the DC voltage exceeds the braking limit. The selection is to be used in applications where several inverters are connected to the same intermediate circuit (DC bus).

6.2.12 Group 28 Motor Model

The Range/Unit column in Table 6-10 below shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-12 Group 28.

Parameter	Range/Unit	Description
1 LONG DISTANCE MODE	OFF; ON	Long distance mode
2 TR TUNE	-60 … +200 %	Rotor time constant tuning

1 LONG DISTANCE MODE This function is used to reduce the maximum voltage peaks in the motor circuit and to reduce the switching frequency of the inverter. This parameter is active as standard in 690V inverter units. It can also be used when the total motor cables are long.

OFF

Long distance mode is disabled.

ON

Long distance mode is enabled.

2 TR TUNE This coefficient affects the calculated rotor time constant according to the motor rating plate values. It is used if the nominal speed value of the motor rating plate does not correspond to the real full load speed. For example, if the real slip is 10% higher than the slip calculated from motor rating plate speed, a coefficient value of +10% is set into this parameter (e.g. if full load speed should be 989 rpm instead of rating plates 990 rpm, for a motor with 1000 rpm no-load speed. Meaning 11 rpm instead of 10 rpm slip).
Note: This parameter is effective only if a pulse encoder is used.

6.2.13 Group 30 Fault Functions

These parameter values can be altered with the CraneDrive running. The Range/Unit column in Table 6-11 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-11 Group 30.

Parameter	Range/Unit	Description
2 PANEL LOSS	FAULT; NO	Operates when the Control Panel is selected as the active control location for the CraneDrive, and the panel stops communicating.
4 MOTOR THERM PROT;	FAULT; WARNING NO	Operates when the motor is thermally overloaded.
5 MOT THERM P MODE	DTC; USER MODE; THERMISTOR	Motor thermal protection mode selection.
6 MOTOR THERM TIME	256.0 s ... 9999.8 s	Time for 63 % temperature rise.
7 MOTOR LOAD CURVE	50.0 % ... 150.0 %	Motor current maximum limit.
8 ZERO SPEED LOAD	25.0 % ... 150.0 %	Motor load curve point at zero speed.
9 BREAK POINT	1.0 Hz ... 300.0 Hz	Break point of motor load curve.
10 MOTOR PHASE LOSS;	NO; FAULT	Operates when a motor phase is lost.
11 EARTH FAULT	NO; FAULT	Operates when there is an earth fault.
12 MASTER FAULT FUNC	FAULT; NO; WARNING	Operates when there is a Fieldbus communication fault
13 COMM FLT TIME-OUT	0.10 s ... 60.00 s	Communication fault time delay

71.□

2 PANEL LOSS

Defines the operation of the CraneDrive if the Control Panel selected as the control location for the CraneDrive stops communicating.

CAUTION: If you select NO, make sure that it is safe to continue operation in case communication with the Control Panel fails.

FAULT

Fault indication is displayed (if there are any Control Panels communicating on the link) and the CraneDrive stops (coast stop + set brake).

NO

No protection provided

4 MOTOR THERM PROT

This parameter defines the operation of the motor thermal protection function which protects the motor from overheating.

FAULT

Displays a warning indication at the warning level. Displays a fault indication and stops the CraneDrive when the motor temperature reaches the 100 % level.

WARNING

Warning indication is displayed when the motor temperature reaches the warning level (95 % of the nominal value).

NO

No protection provided.
Note: Make an init to drive control board if changing parameter to NO after a Fault or Warning is indicated.

5 MOT THERM P MODE

Selects the thermal protection mode. The motor protection is made by means of the thermal model or thermistor measurement.

The CraneDrive calculates the temperature rise of the motor using the following assumptions:

• The motor is in ambient temperature (30 °C) when power is applied to the CraneDrive.

• Motor heating is calculated assuming a load curve (Figure 6-9). The motor will heat above nominal temperature if it operates in the region above the curve, and cool if it operates below the curve. The rate of heating and cooling is set by MOTOR THERM TIME.

Because of the simple thermal model used for calculating temperature rise, this technique of thermal protection may cause undesirable trips if the motor is run continuously at low speeds. If your application requires continuous running at speeds lower than BREAK POINT, you may need to provide external cooling.

CAUTION: Motor thermal protection will not protect the motor if the cooling of the motor is reduced due to dust and dirt.

DTC

The DTC (Direct Torque Control) load curve is used for calculating heating of the motor. Motor thermal time is approximated for standard self-ventilated squirrel-cage motors as a function of the current of the motor and the number of pole pairs.

It is possible to scale the DTC load curve with Parameter 30.7 MOTOR LOAD CURVE if the motor is used in conditions other than described above. Parameters 30.6 MOTOR THERM TIME, 30.8 ZERO SPEED LOAD and 30.9 BREAK POINT cannot be set.

Note: Automatically calculated model (DTC) cannot be applied when 99.6 MOTOR NOM CURRENT > 800 Amp. Instead use USER MODE.

USER MODE

In this mode the user can define the operation of thermal protection by setting Parameters 30.6 MOTOR THERM TIME, 30.7 MOTOR LOAD CURVE, 30.8 ZERO SPEED LOAD and 30.9 BREAK POINT.

THERMISTOR

Motor thermal protection is activated with an I/O signal based on a motor thermistor.

This mode requires a motor thermistor or break contact of a thermistor relay connected between digital input DI6 and +24 V d.c. If direct thermistor connection is used, digital input DI6 activates when resistance rises higher than 4 kΩ. The drive stops if the Parameter 30.4 is preset as FAULT. DI6 is reset to zero when the resistance of the thermistor is between 0 and 1.5 kΩ.

WARNING! According to IEC 664, the connection of the thermistor to the digital input 6 och ACS 800 requires double or reinforced insulation between motor live parts and the thermistor. Reinforced insulation entails a clearance and creepage of 8 mm (400/500 VAC equipment). If the thermistor assembly does not fulfil the requirement, the other I/O terminals of ACS 800 must be protected against contact, or a thermistor relay must be used to isolate the thermistor from the digital input.

WARNING! As the default in CraneDrive digital input 6 is selected as the source for Fast stop. Change this setting before selecting THERMISTOR for Parameter 30.5 MOT THERM P MODE. In other words, ensure that digital input 6 is not selected as signal source by any other parameter than 30.5 MOT THERM P MODE.

6 MOTOR THERM TIME

This is the time within which the motor temperature reaches 63 % of the final temperature rise. Figure 6-9 shows Motor Thermal Time definition. If the DTC mode is selected for motor thermal protection, motor thermal time can be read from this parameter. This parameter can be set only if Parameter 30.5 MOT THERM P MODE is set to USER MODE.

f thermal protection according to UL requirements for NEMA class motors is desired, use this rule of thumb - Motor Thermal Time equals 35 times t6 (t6 in seconds is the time that the motor can safely operate at six times its rated current, given by the motor manufacturer). The thermal time for a Class 10 trip curve is 350 s, for a Class 20 trip curve 700 s and for a Class 30 trip curve 1050 s.

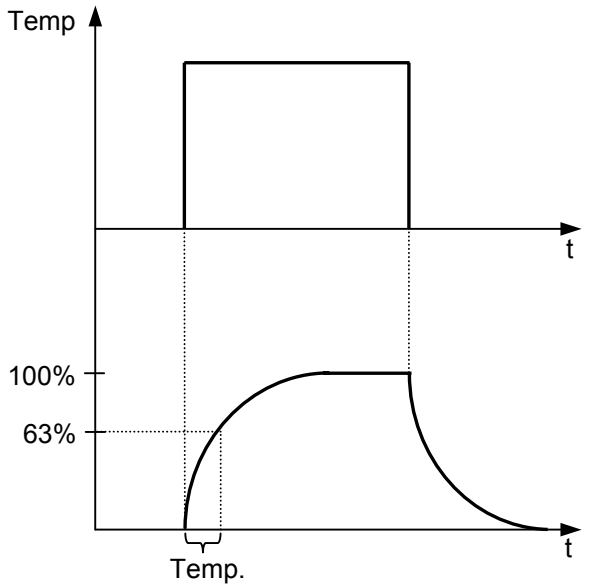


Figure 6-9 Motor Thermal Time.

7 MOTOR LOAD CURVE

The Motor Load Curve sets the maximum allowable operating load of the motor. When set to 100 %, the maximum allowable load is equal to the value of Start-up Data Parameter 99.5 MOTOR NOM CURRENT. The load curve level should be adjusted if the ambient temperature differs from the nominal value.

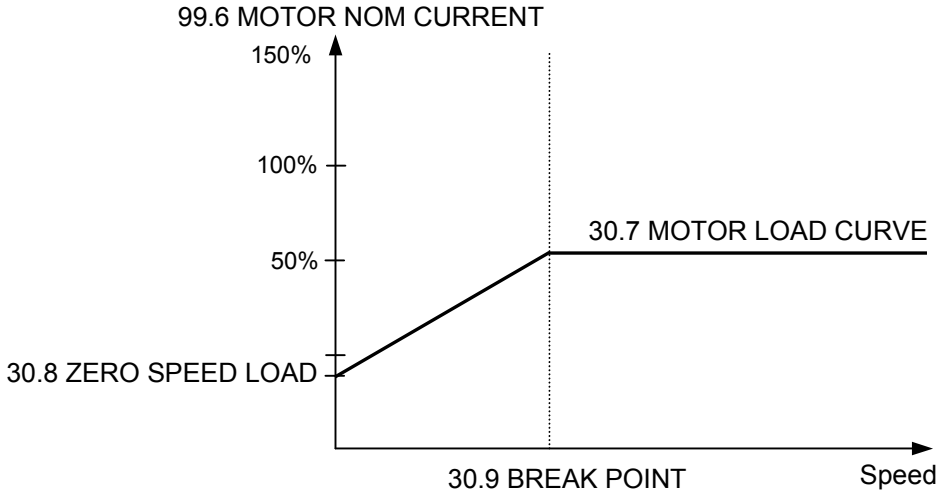


Figure 6-10 Motor Load Curve.

8 ZERO SPEED LOAD

This parameter defines the maximum allowable current at zero speed to define the Motor Load Curve.

9 BREAK POINT

This parameter defines the point at which the motor load curve begins to decrease from the maximum value set by Parameter 30.7 MOTOR LOAD CURVE to the ZERO SPEED LOAD (Parameter 30.8). Refer to Figure 6-10 for an example of motor load curve.

10 MOTOR PHASE LOSS

This parameter defines the operation when one or more motor phases are lost.

FAULT

Fault indication is displayed and the CraneDrive stops (active when motor speed higher than +/- 40 rpm).

NO

No protection provided.

11 EARTH FAULT

This parameter defines the operation when an earth fault is detected in the motor or the motor cable.

FAULT

Fault indication is displayed and the CraneDrive stops.

NO

No protection provided.

12 MASTER FAULT FUNC

This parameter defines the operation when a fault is detected in the communication between the drive and the Fieldbus comm. module.

FAULT

Fault indication COMM MODULE is displayed and the CraneDrive trips.

NO

No activity wanted.

WARNING

Warning indication COMM MODULE is displayed.

13 COMM FLT TIME-OUT

This parameter defines the delay time before activating the fault (see par 30.12).

6.2.14 Group 50 Pulse Encoder

These parameters are visible, and need to be adjusted, only when a pulse encoder module RTAC or NTAC (optional) is installed and activated with Parameter 98.01 ENCODER MODULE.
The parameters in Group 50 define the encoder signal decoding and the operation of the ACS 800 in encoder or RTAC/NTAC module fault conditions.

Table 6-12 Group 50.

Parameter	*Range/Unit*	*Description*
1 PULSE NR	1 … 29999	Number of encoder pulses per Revolution.
2 SPEED MEAS MODE	A_- B DIR; A_-_; A_-_ B DIR; A_-_ B_-_	Calculation of encoder pulses.
3 ENCODER FAULT	WARNING; FAULT	Operation of the CraneDrive if an Encoder failure or encoder Communication failure is Detected.
4 ENCODER DELAY	5 ... 50000 ms	Delay for the encoder Supervision function (See Parameter 50.03 ENCODER FAULT).
5 SPEED FEEDB USED	True; False	Speed feedback used

1 PULSE NR This parameter states the number of the encoder pulses per one revolution.

2 SPEED MEAS MODE This parameter defines how the encoder pulses are calculated.

A_- B DIR
Ch A: positive edges used for calculation of speed and position.
Ch B: direction.

A_-_
Ch A: positive and negative edges used for calculation of speed and position.
Ch B: not used.

A_-_ B DIR
Ch A: positive and negative edges used for calculation of speed and position.
Ch B: direction.

A_-_ B_-_
All edges of the signals A and B are used for calculation of speed and position.

3 ENCODER FAULT

This parameter defines the operation of the CraneDrive if a failure is detected in communication between the pulse encoder and the Pulse Encoder Interface Module (RTAC or NTAC) or in between the RTAC/NTAC module and the RMIO board.

Encoder supervision function activates if either of the following conditions is valid:

1. There is a 20 % difference (filtered) between the estimated speed and the measured speed received from the encoder.
2. No pulses are received from the encoder at start within defined time (see Parameter 50.04 ENCODER DELAY), while the motor torque is at the limit value.

WARNING
Warning indication is generated. Drive will switch over to calculated speed.

FAULT
Fault indication is generated and the CraneDrive stops the motor.

4 ENCODER DELAY

This is the time delay for the encoder supervision function at start (See Parameter 50.03 ENCODER FAULT). If set = 0 ms, this start supervision is disabled.

5 SPEED FEEDB USED

True

The actual speed feedback value from connected encoder module is used in speed & torque control.

False

The actual speed feedback value from connected encoder module is **not** used in speed & torque control (RTAC or NTAC module only used for position measurement).

6.2.15 Group 51 Comm module

For information on these parameters see manual: *ACS800 Fieldbus adapter RxxA-01 Installation & Start-up Guide* for the respective type used.
Note: Fieldbus Command Word and Status word mapping is still as specified in section 5.6.12 of this manual.
Only “Vendor specific mode” is supported by CraneDrive sw (“Generic mode” is not supported) for AnyBus modules, e.g. RPBA-01.

6.2.16 Group 60 Local operation

The Range/Unit column in Table 6-13 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-13 Group 60.

Parameter	Range/unit	Description
1 LOC OPER INH	True ; False	Local operation inhibit
2 LOC SPEED MAX	0-100%	Local speed maximum
3 LOC ZERO SPEED TD	0....300 s	Local zero speed time delay

1 LOC OPER INH

True

Only possible to run in External control.
Note: Panel will show “L” indication even though drive is in External control.

False

Possible to run in LOCAL (panel) control and External control

2 LOC SPEED MAX The maximum speed reference when running in LOCAL

3 LOC ZERO SPEED TD After making a local START the ZERO SPEED signal has to become ”0”, that is motor start running, before the time LOC ZERO SPEED TD has expired otherwise the start order is removed and drive is switched off.

6.2.17 Group 61 Speed monitor

The Range/Unit column in Table 6-14 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-14 Group 61.

Parameter	Range/unit	Description
3 MOT OVERSPEED LEV	0....200 %	Motor overspeed level
4 SPEED LIM 1	0....200 %	Speed limit 1 level

3 MOT OVERSPEED LEV If the motor speed exceeds the level determined by MOT OVERSPEED LEV the drive trips, indicating MOT OVERSP.
100 % setting corresponds to the motor speed set in parameter 69.1 SPEED SCALING RPM.

4 SPEED LIM 1 Relay output indication signal SPEED LIM 1 (selectable in group14) is activated if absolute value of motor speed is above this level.

6.2.18 Group 62 Torque monitor

The Range/Unit column in Table 6-15 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-15 Group 62.

Parameter	***Range/unit***	***Description***
1 TORQ MON SEL	True ; False	Torque monitor select
2 SP DEV LEV	0...100 %	Speed deviation level
3 TORQ FLT TD	0...60000 ms	Torque fault time delay
4 SP DER BLK LEV	0...100 % / s	Speed derivative blocking level

1 TORQ MON SEL **True**

Torque monitor is activated

False

Torque monitor is blocked

2 SP DEV LEV A level above SP DEV LEV means that the speed error is too high

3 TORQ FLT TD If a speed error higher than SP DEV LEV occurs, and if it last longer than the time TORQ FLT TD the drive will trip, indicating TORQ FLT message.

4 SP DER BLK LEV The protection is blocked during acceleration and deceleration if the sign of the speed error is OK and if the derivative of the actual speed is higher than the setting of SP DER BLK LEV.
Calculate as: 100 / (RT x 1.5) %/s , where RT = longest ramp time in seconds.

6.2.19 Group 63 Fast stop

The Range/Unit column in Table 6-16 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-16 Group 63.

Parameter	*Range/unit*	*Description*
1 FAST STOP TYPE 11	NOT USED; FAST STOP 1; FAST STOP 2; FAST STOP 3	Fast stop type 11
2 FAST STOP TYPE 12	NOT USED; FAST STOP 1; FAST STOP 2; FAST STOP 3	Fast stop type 12

1 FAST STOP TYPE 11 Parameter for selecting type of fast stop action from PLC. Activated if signal FAST STOP 11 in Fieldbus communication Command word is set true.

NOT USED = No activity wanted.

FAST STOP 1 = Fast stop by braking on torque limit.

FAST STOP 2 = Fast stop by braking with both mechanical brake and on torque limit.

FAST STOP 3 = Fast stop by braking with mechanical brake only.

2 FAST STOP TYPE 12 Parameter for selecting type of fast stop action in Stand alone mode. Activated by e.g. input DI6. Refer to Parameter 63.1 for settings

6.2.20 Group 64 Crane

The Range/Unit column in Table 6-17 shows the allowable parameter values. The text following the table explains the parameters in detail.

Note: Parameters 64.3 – 64.6 and 64.8 – 64.16 are only active in Stand alone mode (i.e. when 64.1 = True).

Table 6-17 Group 64.

Parameter	*Range/unit*	*Description*
1 STAND ALONE SEL	True; False	Stand Alone Select
2 CONTIN GEAR	True; False	“not used”
3 HIGH SPEED LEVEL 1	0.0 ... 100.0 %	High speed level 1
4 DEADZONE A	0 ... 100 %	Deadzone A
5 DEADZONE B	0 ... 100 %	Deadzone B
6 REF SHAPE	0 ... 100	Reference shape
7 SLOWDOWN SPEEDREF	0 ... 100 %	Slowdown speed reference
8 ZERO POS OK TD	0.0 ... 60.0 s	Zero position OK time delay
9 TORQUE REF SCALE	0 ... 4.00	Torque reference scaling.
10 CONTROL TYPE	JOYSTICK; RADIO CTRL; MOTOR POT; STEP JOYST; STEP RADIO; FB JOYSTICK	Control type selection
11 MINIMUM REF	0.0 ... 100.0 %	Minimum reference
12 JOYSTICK WARN TD	0 ... 5000 ms	Joystick warning time delay
13 STEP REF LEVEL1	0.0 … 100.0 %	Step reference level 1
14 STEP REF LEVEL2	0.0 … 100.0 %	Step reference level 2
15 STEP REF LEVEL3	0.0 … 100.0 %	Step reference level 3
16 STEP REF LEVEL4	0.0 … 100.0 %	Step reference level 4

1 STAND ALONE SEL **True**

Stand alone mode is selected.

False

Fieldbus mode is selected.

2 CONTIN GEAR — *This parameter is not used in ACC sw version 5.2 and later.*

3. HIGH SPEED LEVEL 1 — Joystick output (e.g. AI1) speed reference signal level to give HIGH SPEED signal for power optimisation.

4 DEADZONE A — Deadzone on the joystick before it starts to give reference in direction A (positive, e.g. hoisting direction)

5 DEADZONE B — Deadzone on the joystick before it starts to give reference in direction B (negative, e.g. lowering direction)

6 REF SHAPE — Parameter for making a parabolic curve for the reference
0 = straight line
20 = X^2 curve
100 = X^3 curve

7 SLOWDOWN SPEEDREF — Reduced speed reference (if running in same direction) when slowdown function is activated (e.g. DI5=0).

8 ZERO POS OK TD — Time delay for the joystick to stay in zero position before a new start order can be given after a stop from: trip, fast stop or joystick warning.

9 TORQUE REF SCALE — Scaling of torque reference from joystick (AI.2). E.g. with TORQUE REF SCALE set to 2.0: a 100 % joystick reference will give 200 % torque reference to the torque controller

10 CONTROL TYPE — **JOYSTICK**

External control of drive, in Stand alone mode, is done by using a joystick controller, with Zero Pos (e.g. DI2), Dir A (DI3) and Dir B (DI4) contacts connected to digital inputs and analogue reference connected to AI1 (speed control) or AI2 (torque control). Joystick supervision is active.

RADIO CONTROL

External control of drive, in Stand alone mode, is done by connecting signals from a radio controller or PLC to drive I/O. Dir A and Dir B orders connected to DI3 and DI4 (Zero Pos not required). Reference connected to AI1 (speed control) or AI2 (torque control).

MOTOR POT

External control of drive, in Stand alone mode, is done by using e.g. a pendant controller giving direction and increase orders. Increase orders connected to DI2, Dir A and Dir B connected to DI3 and DI4.

STEP JOYST

External control of drive, in Stand alone mode, is done by using a joystick controller, with Zero Pos (e.g. DI2), Dir A (DI3) and Dir B (DI4) contacts connected to digital inputs and Step type of speed reference connected to digital inputs selected with parameters 10.8 – 10.10. Joystick supervision is active.

STEP RADIO

External control of drive, in Stand alone mode, is done by connecting signals from a radio controller or PLC to drive I/O. Dir A and Dir B orders connected to DI3 and DI4. Step type of speed reference connected to digital inputs selected with parameters 10.8 – 10.10.

FB JOYSTICK (=Fieldbus JOYSTICK)

External control of drive, in Stand alone mode, is done by using a joystick controller connected to a PLC's I/O. Drive receives control signals for Dir A, Dir B, Zero Pos and Reference through fieldbus communication datasets (see end of section 5.6.5 for details).

11 MINIMUM REF	Minimum speed reference in stand alone mode. Normally used with MOTOR POT control type.
12 JOYSTICK WARN TD	Time delay for joystick supervision.
13 STEP REF LEVEL1	First speed reference level applied with startorder, i.e. DirA or DirB, when using STEP JOYST or STEP RADIO control types.
14 STEP REF LEVEL2	Second speed reference level applied when digital input, selected by parameter 10.8 STEP REF2 SEL, is activated (plus start order active).
15 STEP REF LEVEL3	Third speed reference level applied when digital input, selected by parameter 10.9 STEP REF3 SEL, is activated (plus step ref2 conditions still active).
16 STEP REF LEVEL4	Fourth speed reference level applied when digital input, selected by parameter 10.10 STEP REF4 SEL, is activated (plus step ref3 conditions still active).

6.2.21 Group 65 Logic handler

The Range/Unit column in Table 6-18 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-18 Group 65.

Parameter	Range/unit	Description
1 CONTIN ON	True ; False	Continuous on
2 OFF TD	0.0 ... 10000.0 s	Off time delay

1 CONTIN ON Magnetization of the motor will remain on without time limit after the motor is stopped, if parameter CONTIN ON = True.

2 OFF TD The time for how long the Magnetization current shall remain on after the motor is stopped.

6.2.22 Group 66 Torque proving

The Range/Unit column in Table 6-19 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-19 Group 66.

Parameter	*Range/unit*	*Description*
1 TORQ PROV SEL	True ; False	Torque proving select
2 TORQ PROV FLT TD	0.0 ... 100.0 s	Torque proving fault time delay
3 TORQ PROV REF	0.0 ... 200.0 %	Torque proving reference

1 TORQ PROV SEL **True**

Torque proving active (requires pulse encoder).

False

Torque proving not active.

2 TORQ PROV FLT TD Time delay for fault signal TORQ PROV FLT

3 TORQ PROV REF Torque proving reference level.

6.2.23 Group 67 Mechanical brake contr.

The Range/Unit column in Table 6-20 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-20 Group 67.

Parameter	*Range/unit*	*Description*
1 BRAKE FALL TIME	0.0 ... 60.0 s	Brake falling time
2 BRAKE FLT TD	0.0 ... 60.0 s	Brake fault time delay
4 BRAKE REOPEN TD	0.0 … 60.0 s	Brake reopen time delay
5 BRAKE LONG FT TD	0.0 ... 60.0 s	Brake long falling time delay
6 ZERO SPEED LEV	0 ...100 %	Zero speed level
7 ZERO SPEED TIME	0 ...10000 ms	Zero speed time
8 SPEED REF TD	0.05 ... 10.00 s	Speed reference time delay
9 START TORQ SEL	NOT USED; AUTO TQ MEM; LOAD MEAS; PAR 67.10	Starting torque selector
10 START TORQ REF	0 … 300 %	Start torque reference
11 MOTOR TYPE	STANDARD; CONICAL	Conical motor function selector
12 RED FLUX LEVEL	25 ... 100 %	Reduced flux level
13 START FLUX LEVEL	100 ... 140 %	Start flux level
14 START FLUX TIME	0.0 ...10.0 s	Start flux duration

1 BRAKE FALL TIME — Falling time for the mechanical brake. Time for brake to set and give full braking torque after brake close order (brake electrical supply disconnected).

2 BRAKE FLT TD — Time delay for BRAKE FAULT signal.

4 BRAKE REOPEN TD — Minimum time between two brake lift orders. That is BRAKE LIFT must be “False” for at least this time before next start is giving a new BRAKE LIFT order issued. Used if mechanical brake is equipped with a “reduced holding voltage” circuit.

5 BRAKE LONG FT TD — Time delay for monitoring signal ”brake long falltime ”

6 ZERO SPEED LEV — Parameter for setting the speed level for ZERO SPEED indication. Warning: Do not set 0% level. Result would be that brake would never close.

7 ZERO SPEED TIME	Time delay before signal ZERO SPEED is set to ”1” when the motor speed is below ZERO SPEED LEV. If parameter 67.11 MOTOR TYPE is set to CONICAL, than this parameter is used to delay the stop sequence with reduced flux.
8 SPEED REF TD	Time delay at start before releasing speed reference to ramp unit.
9 START TORQ SEL	**NOT USED** = No extra starting torque. **AUTO TQ MEM** = Automatic torque memory selected. Note: value set in parameter 67.10 is used as a minimum value for the torque memory. **LOAD MEAS** = Starting torque reference is received from an superior controller (DS5.2) e.g. measurement from a load cell. **PAR 67.10** = Starting torque reference is fixed using torque level set in parameter 67.10 MIN START TQ REF.
10 MIN START TQ REF	Starting torque reference level used if parameter 67.9 is set to: “PAR 67.10”.
11 MOTOR TYPE	**CONICAL** = Conical motor function active. Reduced flux level at stop set with parameter 67.12 and possibility for increased flux at start (par 67.13 & 67.14). See section 5.6.8 Mecanical brake control, page 5-31, for details on Conical motor function. **STANDARD** = Conical motor function not active.
12 RED FLUX LEVEL	Reduced flux level used when stopping, if Conical motor function is activated in parameter 67.11 . For higher power conical motors on hoists, use a lower value than the default 75% if needed to further reduce “roll-back” when stopping. Note: The reduced flux at stop will increase the motor current during stopping. Therefor it’s normally needed to use one size bigger converter.
13 START FLUX LEVEL	Increased flux level used when starting, if Conical motor function is activated in parameter 67.11 . Increased flux level active during time set in parameter 67.14 .
14 START FLUX TIME	The increased flux level at start (with level set in parameter 67.13) is active during a time set with START FLUX TIME.

6.2.24 Group 68 Power optimisation

The Range/Unit column in Table 6-21 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-21 Group 68.

Parameter	*Range/unit*	*Description*
1 POWOP SELECT	True ; False	Power optimisation select
2 BASE SPEED	1.0 ... 100.0 %	Base speed
3 POWOP AUTOTUNE SEL	True ; False	Powop autotune select
4 INERTIA TOTAL UP	0.00 ... 100.00 KGM2	Inertia total upwards
5 INERTIA TOTAL DWN	0.00 ... 100.00 KGM2	Inertia total downwards
6 TQLIM UP	0.0 ... 200.0 %	Powop torque limit upwards
7 TQLIM DWN	0.0 ... 200.0 %	Powop torque limit downwards
8 POWOP RESET LEV	0 ... 100 %	Power optimisation reset level
9 T MAX	0 … 2000 %	Motor maximum torque capacity
10 LOAD TORQ FILT TC	0 … 32000 ms	Load torque signal filter time constant
11 SLACK ROPE TQ LEV	-400 % … 400 %	Slack rope torque indication level
12 LOADCORR FACT UP	0.00 … 100.00	Loadcorrection factor upwards
13 LOADCORR FACT DWN	0.00 … 100.00	Loadcorrection factor downwards

1 POWOP SELECT **True**

Power optimisation is active (only used on hoist drive).

False

Power optimisation not active.

2 BASE SPEED Breakpoint for Power optimisation calculation. Set in percent of parameter 69.1 SPEED SCALING RPM. Above this speed constant power, corresponding to level set in parameters 68.6 & 68.7 , is obtained.

Normally the speed where field weakening starts and the available RMS power of the motor is constant. Full load torque possible for mechanics up to this speed.

3 POWOP AUTOTUNE SEL

True

Activates the tuning.
Note: Parameter is reset to False after each calculated Total inertia value.

The value of the inertia can be read in actual signal no.1.24 TOTAL INERTIA
An average value after running 2-3 times in each direction should than be entered to parameters INERTIA TOTAL UP and INERTIA TOTAL DWN respectively

False

Autotune mode not active

4 INERTIA TOTAL UP

Total inertia measured in upwards direction

NOTE: Calculation of Inertia parameters has changed compared to previous sw versions (crane application sw version ACAA7020 and earlier). For upgrading a drive with earlier sw versions use the following rescaling formula for Inertia parameters 68.4 and 68.5 .
Inertia(new) = ((8363*Pnom) / (nmax * nnom)) * Inertia(old). Where:
- “Pnom” is the value of parameter 99.9 MOTOR NOM POWER.
- “nmax” is the value of parameter 69.1 SPEED SCALING RPM
- “nnom” is the value of parameter 99.8 MOTOR NOM SPEED.

5 INERTIA TOTAL DWN

Total inertia measured in downwards direction

6 TQLIM UP

Maximum load torque allowed upwards (=field weakening power limit)

7 TQLIM DWN

Maximum load torque allowed downwards (=field weakening power limit)

8 POWOP RESET LEV

Speed level where the calculated power optimisation reference will be reset to be prepared for a new calculation during the next acceleration.

9 T MAX

Motor maximum relative torque capacity (also called “Pull-out torque” or “Breakdown torque” level) per motor catalogue. Often given as e.g. Tmax/Tn = 2.5 (=250%).

Note: Enter motor Tmax value (as normally given in catalogues for sinusoidal supply = direct-on-line data), without subtracting the 30% “frequency converter supply reduction factor”.

If instead having a Tmax/Tn value given as a part of “Inverter parameter settings” values in a motor data sheet, than value must be divided with 0.7 (and multiplied with 100 to get %) before set to parameter 68.9

10 LOAD TORQ FILT TC	Filter time constant for calculated signal 2.31 LOAD TORQUE % (see also page 5-32).
11 SLACK ROPE TQ LEV	Detection level for “slack rope”, (see page 5-33 for more details on “Slack rope” function). Load torque signal (2.31) dropping below this level is considered a “slack rope”, making a Fast stop type 1 to the drive. Setting of -400% (default) will disable the Fast stop.
12 LOADCORR FACT UP	Load correction factor in hoisting direction for LOAD TORQUE % signal 2.31 . To include the mechanical efficiency (in p.u.) of hoist machinery driven by hoist motor as well as motor utilization when hoisting nominal load (i.e. motor torque in p.u. at full load). E.g.: Eff. 0.9 * Util. 1.0 = 0.90 .
13 LOADCORR FACT DWN	Load correction factor in lowering direction. Note: efficiency part for lowering is calculated as 1/mech.eff. E.g. 1/0.9=1.10 .

6.2.25 Group 69 Reference Handler

The Range/Unit column in Table 6-22 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-22 Group 69.

Parameter	Range/unit	Description
1 SPEED SCALING RPM	0 ... 10000 RPM	Maximum speed
2 ACC TIME FORW	0.1 ... 60.0 s	Acceleration time forward
3 ACC TIME REV	0.1 ... 60.0 s	Acceleration time reverse
4 DEC TIME FORW	0.1 ... 60.0 s	Deceleration time forward
5 DEC TIME REV	0.1 ... 60.0 s	Deceleration time reverse
6 S-RAMP TC	0.0 s...10.0 s	S-ramp time constant
7 RAMP SCALE LOCAL	0.5 ... 100.0	Ramp scale local
10 RAMP RATE=1	True ; False; AI3	Ramp rate selection

1 SPEED SCALING RPM — Setting of motor shaft rotational speed (rpm) corresponding to 100 % speed reference.

2 ACC TIME FORW — Setting of acceleration ramp time forward direction (up), 0 to +100 % speed (where 100% corresponds to parameter 69.1).

3 ACC TIME REV — Setting of acceleration ramp time reverse direction (down), 0 to –100 % speed (ref. Parameter 69.1).

4 DEC TIME FORW — Setting of deceleration ramp time forward direction, +100 to 0 % speed (ref. Parameter 69.1).

5 DEC TIME REV — Setting of deceleration ramp time reverse direction, -100 to 0 % speed (ref. Parameter 69.1).

6 S-RAMP TC — Setting of the s-curve time constant in the speed reference ramp unit.

7 RAMP SCALE LOCAL — Scaling (multiplying) factor for ramp times when running in local

10 RAMP RATE=1 — Selection in Fieldbus mode if RAMP RATE signal from PLC controller is not required by drive. Alternatively to activate analog input 3 (AI3) as Ramp rate signal in Fieldbus or Standalone modes.

True

The RAMP RATE signal available from Fieldbus communication is not active, set fixed to 1.0.

False
The RAMP RATE signal from Fieldbus communication (DS3.1) is active.

AI3
The RAMP RATE multiplying factor signal is connected from analog input 3. Signal level at or below 4mA (0 - 4 mA) corresponds to a multiplying factor of 1.0 . Signal levels between 4mA and 20 mA

corresponds to a multiplying factor between 1.0 and 10.0 . Relation is linear, giving e.g. 12 mA = 5.5 .

6.2.26 Group 70 Position measurement

The Range/Unit column in Table 6-23 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-23 Group 70.

Parameter	*Range/unit*	*Description*
1 POS SCALE	1.00 ... 32767.00 PPU	Position scaling
2 SYNC COND	Pos; Neg	Synchronisation condition

1 POS SCALE Set position counter scaling factor, POS SCALE, as number of Pulses Per Unit, e.g. pulses/mm. (Position measurement value POSACT = Pulse counter / POS SCALE.)

Example how to calculate POS SCALE: Hoist operating speed 40 m/min (40.000 mm/min) corresponding to motor speed of 980 rpm. Pulse encoder with 1024 ppr (parameter 50.1). Speed measuring set to use all 4 edges (parameter 50.2=default). This gives us POS SCALE = (980 * 1024 * 4) / 40.000 = 100.35 pulses/mm.

2 SYNC COND **Pos**

The HW synchronisation acts on positive edge (0 -> 1) of e.g. DI3

Neg

The HW synchronisation acts on negative edge (1 -> 0) of e.g. DI3

6.2.27 Group 71 Fieldbus Comm

The Range/Unit column in Table 6-24 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-24 Group 71.

Parameter	*Range/unit*	*Description*
1 COMTEST FLT TD	0...32767 ms	Communication fault time delay
2 RESET POWER ON TD	0...32767 ms	Reset at power on time delay
3 CHOPP/EXT MON TD	0...4000 ms	Chopper & Ext fault monitoring time delay
4 ADVANT COMM TYPE	ENG DRIVE; STD DRIVE	Advant controller communication type
5 DSET BASE ADDRESS	1; 10	Dataset number of the first dataset used for fieldbus communication with PLC.
6 FIELDBUS R-TYPE	NO; RPBA-01	Fieldbus Anybus module selection

1 COMTEST FLT TD — If the Fieldbus communication toggle bit, being sent between the drive and supervisory controller and back, is not changing within the time set in COMTEST FLT TD the drive trips, indicating MAS OSC FLT.

2 RESET POWER ON TD — After power on acknowledgement signal POWER ON ACKN (e.g. DI2=”1”) is received, a reset of the drive is done after the time RESET POWER ON TD.

3 CHOPP/EXT MON TD — Monitoring of external Chopper fault (selected with parameter 10.7, e.g. input DI4=0) and External fault (selected with parameter 30.3), is disabled at power on (POWER ON ACKN=1) during the time CHOPP/EXT MON TD.

4 ADVANT COMM TYPE — Selection of Advant controller communication type if communicating via Advant controller Module bus port (AC70, AC80, AC800M, AC410 with FCI or AC450 with FCI).

ENG DRIVE

“Engineered” type of Advant communication (e.g. Advant controller selections “ACS 600 Eng” or “DRIENG”). Maximum 10 datasets/direction possible i.e. all ACC 800 datasets (1 – 12) are accessable.

STD DRIVE

“Standard” type of Advant communication (e.g. Advant controller selections “ACS 600 Std” or “DRISTD”). Maximum 2 datasets/direction possible i.e. only ACC 800 datasets 1 – 4 are accessable.

5 DSET BASE ADDRESS

Dataset number of the first dataset used for fieldbus communication with the overriding control system (e.g. Advant controller). The dataset addressed by this parameter is the first dataset ***to*** the drive, while the next dataset is the first dataset ***from*** the drive, and so on.

1

Dataset range is: 1 … 12. Where dataset 1, 3, 5 & 7 is to the drive and datasets 2, 4, 6, 8 & 12 is from the drive to PLC. Used for example with AC800M ModuleBus if “ABB Standard Drive” type of drive unit is selected.

10

Dataset range is: 10 … 21. Where dataset 10, 12, 14 & 16 is to the drive and datasets 11, 13, 15, 17 & 21 is from the drive to PLC. Used for example with AC800M ModuleBus if “ABB Engineered Drive” type of drive unit is selected.

6 FIELDBUS R-TYPE

Possibility to preset ACC800 default settings of Group51 fieldbus parameters if Anybus module (“R-type”) used. Settings are done to configure fieldbus signals as described in manual section 5.6.12 .

RPBA-01

Default settings for Profibus parameters in group 51 changed to: 51.05=3, 51.06=6, 51.07=7, 51.08=10, 51.09=8, 51.10=11, 51.11=9, 51.12=12, 51.13=13, 51.14=16, 51.15=14, 51.16=17, 51.17=15, 51.18=18, 51.19=19, 51.20=22 .

6.2.28 Group 72 Master/Follower

The Range/Unit column in Table 6-25 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-25 Group 72.

Parameter	Range/unit	Description
1 MAST/FOLL MODE	OFF; MASTER; FOLLOWER (visible only if M/F CTRL macro selected)	Master/Follower mode selection
2 TORQUE SELECTOR	ZERO; SPEED; TORQUE; MINIMUM; MAXIMUM; ADD	Torque selector setting
3 LOAD SHARE	0.0 % ... 400.0 % (visible only if M/F CTRL macro selected)	Load sharing
4 WINDOW SEL	OFF; ON	Window ctrl selection ~~on~~
5 WINDOW WIDTH POS	0.0 rpm...1500.0 rpm	Window width positive
6 WINDOW WIDTH NEG	0.0 rpm...1500.0 rpm	Window width negative
7 DROOP RATE	0.0 % ... 100.0 %	Droop rate
8 TORQ REF A FTC	0 ms ... 32767 ms (visible only if M/F CTRL macro selected)	Torque reference A filter time constant
9 M/F FAULT TD	0 ms ... 32767 ms (visible only if M/F CTRL macro selected)	Master/Follower fault time delay
10 M/F COMM ERR TD	0 ms ... 32767 ms (visible only if M/F CTRL macro selected)	Master/Follower communication error time delay
11 MF BROADCAST MODE	NO; YES	Master/Follower broadcast mode

1 MAST/FOLL MODE Master and follower drive operating mode.

OFF

Master or Follower drive not activated, only separate control (or Local) available.

MASTER

Drive selected to be the Master drive in M/F control.

FOLLOWER

Drive selected to be the Follower drive in M/F control.

2 TORQUE SELECTOR Mode selection for Follower drive.

ZERO

Torque selector parameter is not active. Speed or torque control selection is done with I/O or Fieldbus in normal way (default is speed control).

SPEED

Drive is speed controlled. Receiving speed reference (Speed_ref3 ramp output!) from Master drive if M/F ctrl macro active i.e. using M/F bus communication. Note: Follower speed ramp times should be set equal or lower than Master ramp time settings.

TORQUE

Drive is torque controlled. Receiving torque reference from Master drive if M/F ctrl macro active (Torq ref A), i.e. load sharing between Master and Follower.

MINIMUM

Torque selector compares the torque reference and the output of the speed controller. The lower value is used as the reference for motor torque control. Receiving speed and torque references from Master drive if M/F ctrl macro active. **This mode should normally not be used with a crane drive!**

MAXIMUM

Torque selector compares the torque reference and the output of the speed controller. The higher value is used as the reference for motor torque control. Receiving speed and torque references from Master drive if M/F ctrl macro active. **This mode should normally not be used with a crane drive!**

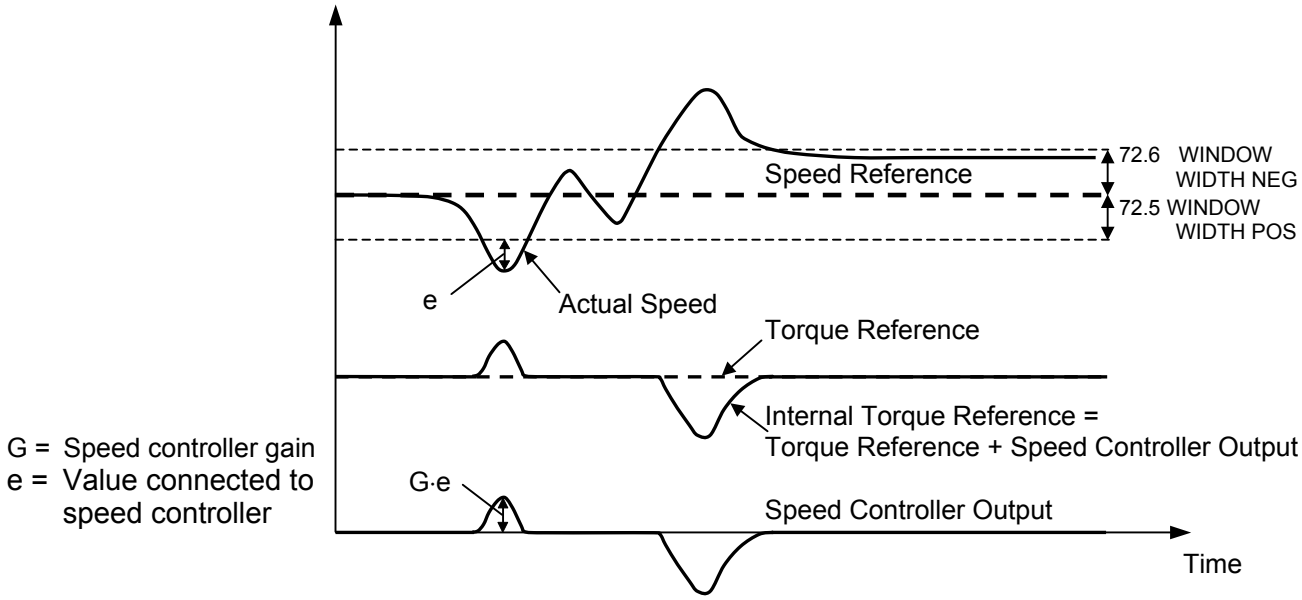
ADD

Torque selector adds the speed controller output to torque reference. The drive is torque controlled in normal operating range.

The selection ADD together with the window control form a speed supervision function for a torque controlled Follower drive:

- In normal operating range, the Follower follows the torque reference (TORQ REF A).
- Window control keeps the speed controller input and output to zero as long as the speed error (speed reference – actual speed) remains within a certain window
- If the speed error goes out of the window, window control connects the error to the speed controller. The speed controller output increases or decreases the internal torque reference, stopping the rise or fall of the actual speed.

Window Control



3 LOAD SHARE — Follower drive setting adjusts the load split between Master and Follower. 100% setting causes the Follower drive to produce the same percent of motor nominal torque as the Master drive, i.e. 50/50 load split.

4 WINDOW SEL — Window control together with the selection of ADD of Parameter 72.2 TORQUE SELECTOR form a speed supervision function for a torque controlled drive.

OFF

Window control is off.

ON

Window control is on. This selection should be used only when Parameter 72.2 TORQUE SELECTOR is set to ADD. Window control supervises the speed error value (Speed Reference – Actual Speed). In normal operating range the window control keeps the speed controller input at zero. The speed controller is evoked only if:

- the speed error exceeds the value of Parameter 72.5 WINDOW WIDTH POS or
- the absolute value of the negative speed error exceeds the value of Parameter 72.6 WINDOW WIDTH NEG.

When the speed error goes outside the window the exceeding part of the error value is connected to the speed controller. The speed controller produces a reference term relative to the input and gain of the speed controller (Parameter 23.1 GAIN) which the torque selector adds to the torque reference. The result is used as the internal torque reference for CraneDrive.

For example, in a load loss condition, the internal torque reference of the drive is decreased, preventing the excessive rise of motor speed. If the window control were inactivated, the motor speed would rise until a speed limit of the CraneDrive was reached. Parameters 20.1 MINIMUM SPEED and 20.2 MAXIMUM SPEED set the speed limits.

5 WINDOW WIDTH POS — This parameter value is considered only if the window control is on. The allowed setting range is from 0 to 1500 rpm.

The speed controller input is kept to zero until the positive speed error exceeds the value WINDOW WIDTH POS.

6 WINDOW WIDTH NEG — This parameter value is considered only if the window control is on. The allowed setting range is from 0 to 1500 rpm.

The speed controller input is kept to zero until the absolute value of the negative speed error exceeds WINDOW WIDTH NEG.

7 DROOP RATE

This parameter value needs to be changed only if both the Master and the Follower are speed controlled.

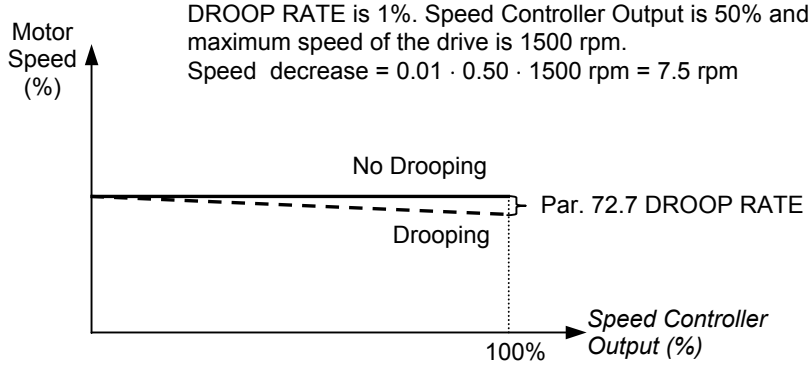
CAUTION ! Follower speed control or drooping should not be used if the motor shafts of the Master and the Follower are solidly coupled together (e.g. gearbox or common rail).

Drooping slightly decreases the drive speed as the drive load increases in order to provide better load sharing between the Master and Follower drives. The correct droop rate for each installation needs to be determined case by case. If drooping is used it is recommended to set some droop rate both for the Follower and Master drives.

The droop rate is set as % of the drive maximum speed. The actual speed decrease in a certain operating point depends on the droop rate setting and the internal torque reference of the drive (speed controller output).

Speed Decrease =
Drooping · Speed Controller Output · Max. Speed

Calculation Example:
DROOP RATE is 1%. Speed Controller Output is 50% and maximum speed of the drive is 1500 rpm.
Speed decrease = 0.01 · 0.50 · 1500 rpm = 7.5 rpm



At 100 % speed controller output, drooping is at its maximum level i.e. equal to the value of the DROOP RATE. The drooping effect decreases linearly to zero along with the decreasing load.

8 TORQ REF A FTC

Filtering time constant for torque reference TORQ REF A in Follower drive, received from Master drive.

9 M/F FAULT TD

When the Follower drive have received start-order from Master drive, both drives check that they have signal RUNNING=1 within the time M/F FAULT TD. If not the drive will trip, indicating MF RUN FLT. NOTE: Master drive will trip as a result of a Follower drive tripping

10 M/F COMM ERR TD

As soon as the Master and the Follower are activated (Parameter 72.1 MAST/FOLL MODE), they start to monitor a bus communication toggle bit that is sent between the two drives. If the toggle bit stops longer than the time M/F COMM ERR TD the drive trips, indicating MF COMM ERR. NOTE: This delay for MF COMM ERR is not active if using Master/Follower Broadcast mode.

11 MF BROADCAST MODE Enable Master/Follower broadcast mode if multiple Follower drives are required. Set = YES in both broadcast Master and Followers. If broadcast mode is selected, Master drive will send only Speed and Torque reference to all drives set as Followers (par. 72.1). Master and Followers to have channel 2 connected together in a **closed** optical ring. On and Start orders must be connected via I/O or Fieldbus (Standalone or Fieldbus mode used, par. 64.1) directly to each drive in Master as well as Followers. Also monitoring of e.g. Running signal from all drives must be done externally.

NO

Master/Follower Broadcast mode disabled. Normal point-to-point Master/Follower communication with only one Follower is possible.

YES

Master/Follower Broadcast mode is enabled.

6.2.29 Group 73 Electric Shaft

The Range/Unit column in Table 6-26 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-26 Group 73

Parameter	***Range/unit***	***Description***
1 ELSHAFT MODE SEL	OFF; MASTER; SLAVE	Electric shaft mode selection
2 ELSHAFT GAIN	0.0 …100.0	Electric shaft control gain
3 GEAR NUMERATOR	1 …32000	Gear scaling numerator
4 GEAR DENOMINATOR	1 …32000	Gear scaling denominator
5 POS ERROR LIMIT	0 …1000 “pos units”	Position error fault limit
6 ELSH CTRL MIN SPD	0 … 100 %	Electric shaft control minimum speed

1 ELSHAFT MODE SEL Electric shaft drive mode selection.

OFF

Master or Slave drive not activated for Electric Shaft control.

MASTER

Drive selected to be the Master drive in Electric shaft control. Required also to set parameter 99.2. Application macro = M/F CTRL and to set 72.1 Mast/Foll mode = MASTER.

SLAVE

Drive selected to be the Slave drive in Electric shaft control. Required also to set parameter 99.2. Application macro = M/F CTRL, parameter 72.1 Mast/Foll mode = FOLLOWER and 72.2 Torque selector = SPEED.

2 ELSHAFT GAIN Electric shaft controller (P-controller) gain. Only active in Slave drive. With Elshaft Gain = 0.1 there is a –0.1% speed correction used for Slave drive if the position error (Slave signal 2.26) between Master and Slave is 1 unit.
See also section 5.5.14 for the description of Electric shaft control.

3 GEAR NUMERATOR This parameter is, together with parameter 73.4 Gear Denominator, used for giving the mechanical speed ratio between Master and Slave.
Speed ratio Master/Slave = Gear Numerator/Gear Denominator. This ratio factor is multiplied with the speed reference and position value in Slave drive only when Electric shaft control is active (On).

Example: Hoist with Master and Slave drive having equal setting for the maximum operating speed (100%) parameter 69.1 Speed scaling rpm. Gear boxes are selected with different ratio so that full speed of Master drive corresponds to a rope speed of 3.6 m/min and full speed of Slave drive corresponds to a rope speed of 6.4 m/min; meaning we have a speed ratio = 3.6/6.4 = 0.5625 between Master and Slave.
To run the two drives together (Electric shaft control on) with the same rope speed (0 – (+/-)3.6 m/min) we should set parameter 73.3 Gear Numerator = 36 and parameter 73.4 Gear Denominator = 64 (36/64 = 0.5625). Parameter 70.1 POS SCALE should be set to same value in both drives.
NOTE: Parameter only active in Slave drive.

4 GEAR DENOMINATOR — See the description above for parameter 73.3.

5 POS ERROR LIMIT — If position error (signal 2.26) between Master and Slave drive, when Electric shaft control is on, exceeds this value, drives will trip and the Slave indicate “ELECTR SHAFT” fault. Master will then also indicate “FOLL FAULT” (Follower fault). A Reset command to Master drive will reset both drives. Unit is “pos units” (e.g. mm) according to scaling done in parameter 70.1 POS SCALE.
The parameter is only active in Slave drive.

6 ELSH CTRL MIN SPD — Electric shaft control is only active at motor speeds (without sign) above this minimum speed level. Meaning controller is inactive around zero speed e.g. during start and stop. When passing this speed limit the controllers output is gradually released respectively removed (i.e. ramped up during start resp. ramped to zero during stop) to make a smooth change. Any accumulated position error when running below this speed limit (e.g. when motors stopped) will be controlled to zero as soon as motor is running above the minimum speed limit ELSH CTRL MIN SPD again.
The parameter is only active in Slave drive.

6.2.30 Group 74 Crane Lifetime

The Range/Unit column in Table 6-27 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-27 Group 74

Parameter	Range/unit	Description
1 NOMINAL LOAD	0.00 ... 32767.00 ton	Nominal hoist load
2 CRANE LIFETIME	0 … 12500 hrs	Crane lifetime
3 START LIFETIMEMON	OFF; ON	Start crane lifetime monitor

1 NOMINAL LOAD — Nominal (full) load for crane hoist in tons, corresponding to 100% Load torque (signal 2.31).

2 CRANE LIFETIME — The designed mechanical lifetime of crane hoist in hours. When the calculated LIFETIME LEFT signal 1.35 is below 10% the drive will give a warning “LIFETIME>90%”.

3 START LIFETIMEMON — The Crane Lifetime monitor calculation of the “Load spectrum factor Km” (signal 1.34) is started by setting parameter START LIFETIMEMON=ON. Note: parameter cannot be reset with user parameters once set to ON during drive commissioning.

6.2.31 Group 90 Dataset REC Addr

The Range/Unit column in Table 6-28 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-278 Group 90

Parameter	Range/Unit	Description
1 DATASET 7 WORD 1	0 … 9999	Address for Dataset 7 Word 1
2 DATASET 7 WORD 2	0 … 9999	Address for Dataset 7 Word 2
3 DATASET 7 WORD 3	0 … 9999	Address for Dataset 7 Word 3

Group 90 is used to define the drive parameters into which the values of Dataset 7 Words 1 – 3 are written.

1 DATASET 7 WORD 1 Drive parameter, group and index, to get value from fieldbus dataset 7 word 1 integer value. Integer scaling for “decimal parameters” given by number of decimals, e.g. parameter 69.2 = 5.0 sec equals integer value of 50.
Format: **xxyy**, where **xx** = Parameter Group (10 to 99), **yy** = Parameter Index (always using 2 digits, i.e. 1 = 01).
Example: Setting **2001** = Parameter 20.1 MINIMUM SPEED receives it’s value from fieldbus dataset 7 word 1.

2 DATASET 7 WORD 2 Refer to Parameter 90.1 DATASET 7 WORD 1

3 DATASET 7 WORD 3 Refer to Parameter 90.1 DATASET 7 WORD 1

6.2.32 Group 92 Dataset TR Addr

The Range/Unit column in Table 6-29 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-289 Group 92

Parameter	Range/Unit	Description
1 DATASET 4 WORD 1	0 … 9999	Address of Dataset 4 Word 1
2 DATASET 4 WORD 2	0 … 9999	Address of Dataset 4 Word 2
3 DATASET 4 WORD 3	0 … 9999	Address of Dataset 4 Word 3
4 DATASET 6 WORD 1	0 … 9999	Address of Dataset 6 Word 1
5 DATASET 6 WORD 2	0 … 9999	Address of Dataset 6 Word 2
6 DATASET 6 WORD 3	0 … 9999	Address of Dataset 6 Word 3
7 DATASET 8 WORD 1	0 … 9999	Address of Dataset 8 Word 1
8 DATASET 8 WORD 2	0 … 9999	Address of Dataset 8 Word 2
9 DATASET 8 WORD 3	0 … 9999	Address of Dataset 8 Word 3

Group 92 is used as a signal “switchbox” to connect signals from Groups 1 - 5 to Fieldbus datasets 4, 6 & 8 words 1 - 3.

1 DATASET 4 WORD 1 Address selection, Group and Index, for Fieldbus dataset 4 word 1. Example: To connect signal SPEED REF3 for transmission in Dataset 4 Word 1, set parameter 92.1 = 202 . That is 202 = Group 2, Index 02.

2 DATASET 4 WORD 2 Refer to Parameter 92.1 DATASET 4 WORD 1

3 DATASET 4 WORD 3 Refer to Parameter 92.1 DATASET 4 WORD 1

4 DATASET 6 WORD 1 Refer to Parameter 92.1 DATASET 4 WORD 1

5 DATASET 6 WORD 2 Refer to Parameter 92.1 DATASET 4 WORD 1

6 DATASET 6 WORD 3 Refer to Parameter 92.1 DATASET 4 WORD 1

7 DATASET 8 WORD 1 Refer to Parameter 92.1 DATASET 4 WORD 1

8 DATASET 8 WORD 2 Refer to Parameter 92.1 DATASET 4 WORD 1

9 DATASET 8 WORD 3 Refer to Parameter 92.1 DATASET 4 WORD 1

6.2.33 Group 98 Option modules

The Range/Unit column in Table 6-30 shows the allowable parameter values. The text following the table explains the parameters in detail.

Table 6-30 Group 98

Parameter	Range/Unit	Description
1 ENCODER MODULE	NTAC; NO; RTAC-SLOT1; RTAC-SLOT2; RTAC-DDCS	Pulse encoder option module selection.
2 COMM. MODULE	NO; FIELDBUS; ADVANT	Communication option module selection.
3 CH3 NODE ADDR	1 ... 254	Channel 3 node address
4 CH0 NODE ADDR	0 … 125	Channel 0 node address
5 DI/O EXT MODULE 1	NDIO; NO; RDIO-SLOT1; RDIO-SLOT2; RDIO-DDCS	Digital I/O extension module 1 selection
6 DI/O EXT MODULE 2	NDIO; NO; RDIO-SLOT1; RDIO-SLOT2; RDIO-DDCS	Digital I/O extension module 2 selection
7 AI/O EXT MODULE	NAIO; NO; RAIO-SLOT1; RAIO-SLOT2; RAIO-DDCS	Analogue I/O module selection

The parameters for the option module group are set if an option module is installed. For more information on option module parameters refer to the option module manuals.

1 ENCODER MODULE

Activates the communication to the optional pulse encoder module. The drive will than use the measured speed signal instead of the calculated speed.
Parameters in group 50 ENCODER MODULE must be set before operation.

NTAC

Communication active. Module type: NTAC-02 module. Connection interface: Fiber optic DDCS link (connect to Ch1 on RDCO option module). Node address in NTAC-02 to be 16.

NO

Inactive.

RTAC-SLOT1

Communication active. Module type: RTAC. Connection interface: Option slot 1 of the drive control unit (RMIO board).

RTAC-SLOT2

Communication active. Module type: RTAC. Connection interface: Option slot 2 of the drive control unit (RMIO board).

RTAC-DDCS

Communication active. Module type: RTAC. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fiber optic DDCS link (via Ch1 on RDCO option module). Note: Node ID selector (S1) on RTAC must be set to 0 (=default).

2 COMM. MODULE — Set to FIELDBUS if a communication option module, e.g. NMBA-01 is connected to channel 0 of CraneDrive. Parameters in group 51 must be set before operation.
Set to ADVANT if optical "Modulebus" of ABB ADVANT controllers AC70, AC80, AC410 (CI810), AC450 (CI810), AC800M or if AC80 "Drivebus" is connected to RDCO-01 channel 0 of CraneDrive.
NOTE: If changing parameter 98.2 from ADVANT to FIELDBUS, parameter 98.4 must be set = 1.

3 CH3 NODE ADDR — Set a different node address for DDCS channel 3 in each drive, if connecting multiple drives together to DriveWindow PC-tool communication (ring or star connection).

4 CH 0 NODE ADDR — Set node address for RDCO channel 0 if connected to Advant controller optical Modulebus or AC80 Drivebus (98.2 = ADVANT).
NOTE: If changing parameter 98.2 from ADVANT to FIELDBUS, parameter 98.4 must be set = 1.
The ch 0 node address is set according to the Module bus POSITION value used for this drive, by using the following conversion:
If POSITION = yzw than calculate drive ch 0 node address 98.4 as y*16+zw.
Example: If POSITION = 101 than Par 98.4 = 1*16+01 = 17
101 → 17, 102 → 18, … 112 → 28
201 → 33, 202 → 34, … 212 → 44
:
701 → 113, 702 → 114, … 712 → 124

If using AC80 Drivebus, ch 0 node address is set equal to Drive Number setting on ACSRX function block in AC80.

If connecting to AC800M Module bus, see also parameter 71.5 DSET BASE ADDRESS.

5 DI/O EXT MODULE 1 — Activates the communication to the optional digital I/O extension module 1 and defines the type and connection interface of the module. This is used to extend the number of inputs and outputs. See parameter groups 10 and 14 for possible connections.

NDIO

Communication active. Module type: NDIO module. Connection interface: Fiber optic DDCS link (connect to Ch1 on RDCO option

module). Set the module node address to 2 (for directions see module manual).
Signals available are: EXT DI1.1, EXT DI1.2, EXT1 DO1, EXT1 DO2.

NO

Inactive.

RDIO-SLOT1

Communication active. Module type: RDIO. Connection interface: Option slot 1 of the drive control unit (RMIO board).
Signals available are: EXT DI1.1, EXT DI1.2, EXT DI1.3, EXT1 DO1, EXT1 DO2.

RDIO-SLOT2

Communication active. Module type: RDIO. Connection interface: Option slot 2 of the drive control unit (RMIO board).
Signals available are: EXT DI1.1, EXT DI1.2, EXT DI1.3, EXT1 DO1, EXT1 DO2.

RDIO-DDCS

Communication active. Module type: RDIO. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fiber optic DDCS link (via Ch1 on RDCO option module).
Note: Node ID selector (S1) on RDIO must be set to 2 (=default).
Signals available are: EXT DI1.1, EXT DI1.2, EXT DI1.3, EXT1 DO1, EXT1 DO2.

6 DI/O EXT MODULE 2

Activates the communication to the optional digital I/O extension module 2 and defines the type and connection interface of the module. This is used to extend the number of inputs and outputs. See parameter groups 10 and 14 for possible connections.

NDIO

Communication active. Module type: NDIO module. Connection interface: Fiber optic DDCS link (connect to Ch1 on RDCO option module). Set the module node address to 3 (for directions see module manual).
Signals available are: EXT DI2.1, EXT DI2.2, EXT2 DO1, EXT2 DO2.

NO

Inactive.

RDIO-SLOT1

Communication active. Module type: RDIO. Connection interface: Option slot 1 of the drive control unit (RMIO board).
Signals available are: EXT DI2.1, EXT DI2.2, EXT DI2.3, EXT2 DO1, EXT2 DO2.

RDIO-SLOT2

Communication active. Module type: RDIO. Connection interface: Option slot 2 of the drive control unit (RMIO board).
Signals available are: EXT DI2.1, EXT DI2.2, EXT DI2.3, EXT2 DO1, EXT2 DO2.

RDIO-DDCS

Communication active. Module type: RDIO. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fiber optic DDCS link (via Ch1 on RDCO option module).
Note: Node ID selector (S1) on RDIO must be set to 3.
Signals available are: EXT DI2.1, EXT DI2.2, EXT DI2.3, EXT2 DO1, EXT2 DO2.

7 AI/O EXT MODULE Activates the communication to the optional analog I/O extension module and defines the type and connection interface of the module. Used when connecting analogue +/- 10V Speed correction reference signal to Ext AI1 (available in both Stand alone and Fieldbus mode), and when connecting an analogue 0-10V Load measure reference to Ext AI2 (see also description for parameter 67.9 START TORQ SEL).

.

NAIO

Communication active. Module type: NAIO-02 module. Connection interface: Fiber optic DDCS link (connect to Ch1 on RDCO option module). Set the module node address to 5 (for directions see module manual)..

NO

Inactive.

RAIO-SLOT1

Communication active. Module type: RAIO. Connection interface: Option slot 1 of the drive control unit (RMIO board).

RAIO-SLOT2

Communication active. Module type: RAIO. Connection interface: Option slot 2 of the drive control unit (RMIO board).

RAIO-DDCS

Communication active. Module type: RAIO. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fiber optic DDCS link (via Ch1 on RDCO option module).
Note: Node ID selector (S1) on RAIO must be set to 5.

6.2.34 Group 99 Start-up Data

See Chapter 3 Start-up Data for information on these parameters.

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Chapter 7 - Fault Tracing and Maintenance

7.1 Overview

The CraneDrive is equipped with advanced protection features that continuously guard the unit against damage and down time due to incorrect operating conditions and electrical and mechanical malfunctions. This chapter explains the CraneDrive fault tracing procedure with the CDP 312R Control Panel.

All Warning and Fault messages (including the ones from user definable Programmable Fault Functions) are presented in Table 7-1 and Table 7-2 with information on the cause and remedy for each case. Fault and Warning indications are displayed in the Actual Signal Display Mode as well as in the Parameter Mode. Warnings do not have a direct effect on operation. Faults terminate motor operation.

The standard maintenance measures are described in the latter part of this chapter.

Most Warning and Fault conditions can be identified and cured with the information in this manual. There are, however, some situations that can only be treated by an ABB service representative. The unit is fitted with complex circuitry, and measurements, parts replacements and service procedures not described in this manual are not allowed for the user.

Programmable Fault Functions are explained in detail in chapter 6, Group 30. Signal Group 5 (Information) shows software versions of the unit.

CAUTION! Do not attempt any measurement, parts replacement or other service procedure not described in this manual. Such action will void guarantee, endanger correct operation, and increase downtime and expense.

WARNING! All electrical installation and maintenance work described in this *Chapter 7– Fault Tracing and Maintenance* should only be undertaken by a qualified electrician. Disconnect mains power if fault tracing involves work inside the frame, the motor or the motor cable. For CraneDrive units with EMC Line Filter disconnect mains power at the distribution board. **The fuse switch (with handle in the front door) of the enclosed ACS 800 does not switch off power from the EMC Line Filter.** Wait 5 minutes for the intermediate circuit capacitors to discharge. The ACS 800 can contain dangerous voltages from external control circuits. Exercise appropriate care when working on the unit. Neglecting these instructions can cause physical injury and death.

WARNING! The printed circuit boards contain integrated circuits that are extremely sensitive to electrostatic discharge. Exercise appropriate care when working on the unit to avoid permanent damage to the circuits.

7.2 Warnings

The Control Panel enters the Fault Display when a Warning condition is detected. The Fault Display shows the cause of the Warning. The programmable warning messages are displayed when the value of the Parameter 30.4 and 30.12 is set as WARNING. The default settings of the Programmable Fault Functions are given in *Appendix A– Complete Parameter and default settings.*
Table 7-1 contains the Warning messages, their most likely causes and possible remedies. An example of a Warning message is displayed in Figure 7-1.

```
1 L ->   50.0%    1
ACS800-01     75 kW
** WARNING **
ACS 800 TEMP
```

Figure 7-1. A Warning display.

The Warning does not have a direct effect on frequency converter operation. The message disappears when any of the Control Panel keys are pressed. The Warning will reappear in one minute if conditions remain unchanged.

In the most critical applications it might be practical to terminate the process in a controlled manner rather than run the risk of a Fault trip.

If a Warning persists despite the actions indicated in the remedy column, contact an ABB service representative.

Table 7-1 The ACC Warning Messages

Warning	***Cause***	***Remedy***
ACS 800 TEMP	The ACS 800 internal temperature is excessive. A warning is given if inverter module temperature exceeds 125 °C.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
BRAKE L FT	Brake Falling Time at stop longer than time delay BRAKE LONG FT TD (Parameter 67.5) gives a warning signal that will not trip the drive but activate Watchdog output signal, to be used for Emergency stop of crane.	Check brake contactor. Check wiring of brake acknowledgement to digital input 1.
BR OVERHEAT	Brake resistor overheated.	Stop drive. Let resistor cool down. Check parameter settings of resistor overload protection function (see parameter group 27 BRAKE CHOPPER). Check that braking cycle meets allowed limits.
DRV ID CHG	The ID number of the drive has been changed from 1 in Drive Selection Mode (the change is not shown on the display). If the ID number is not changed back to 1 during the session, the panel will not be able to communicate with the drive after the next power-up.	Go to Drive Selection Mode by pressing **DRIVE**. Press **ENTER**. Set the ID number to 1. Press **ENTER**. If the panel does not communicate with the drive, set the ID number of the drive to 1 as explained in chapter 2.
ID DONE	The drive has performed the motor identification of magnetisation and is ready for operation. This warning belongs to the normal start-up procedure.	Continue drive operation.
ID MAGN	Motor identification of magnetisation is ongoing. This warning belongs to the normal start-up procedure.	Wait until the drive indicates that
ID RUN FAIL	The Motor ID Run is not completed successfully.	Check the maximum speed (Parameter 20.2) It should be at least 80 % of the nominal speed of the motor (Parameter 99.8).
LIFETIME>90%	Calculated mechanical lifetime (in Crane Lifetime Monitor function) of hoist has exceeded 90% of the setting of parameter 74.3 CRANE LIFETIME.	Crane is in need of mechanical overhaul (reconditioning). Please contact crane builder.
MOTOR TEMP (programmable Fault Function 30.4 .. 30.10)	Motor temperature is too high (or appears to be too high). This can be caused by excessive load, insufficient motor power, inadequate cooling or incorrect start-up data.	Check motor ratings, load and cooling. Check start-up data. Check MOTOR TEMP Fault Function parameters (*see chapter 6, group 30)*.
NO MOT DATA	Motor data is not given or motor data does not match with inverter data.	Check the motor data given by Parameters 99.4 ... 99.9.
THERMISTOR (programmable Fault Function 30.4 ... 30.5)	Motor thermal protection mode selected as THERMISTOR and the temperature is excessive.	Check motor ratings and load. Check start-up data. Check thermistor connections for digital input DI6.

USER MACRO	User Macro is being saved.	Please wait.
WARNING JOYSTICK	The drive is stopped and prevented from start. If Stand Alone Sel (Parameter 64.1) is “True” and Control Type (Par 64.10) is “JOYSTICK” Conditions: - START DIR A= ”1” and START DIR B=”1” simultaneously - SPEED REF is > 1V or TORQUE REF is > 2Ma and ZERO POS =”1”	Check joystick and wiring to digital inputs 2 - 4 and analogue inputs 1 or 2. Check setting of parameter 64.1 (Stand Alone Sel) if using fieldbus control
	Or if Stand Alone Sel (Parameter 64.1) is “True”, Control Type (Par 64.10) is <u>not</u> “FB JOYSTICK” and FB Stoplim Sel (Par 10.14) is set to “DI3+DI4”. That is, DI3 & DI4 is incorrectly used for both Direction orders A & B as well as Stoplimits A & B.	Change selection of FB Stoplim Sel, parameter 10.14.

7.3 Faults

The Control Panel enters the Fault Display when a Fault condition is detected. Motor operation is terminated. The Fault Display shows the cause for the Fault. The programmable Fault messages are displayed when the value of the Parameter is FAULT. The default setting of the Programmable Fault Functions are given in Appendix A – *Complete Parameter and Default Settings.*

If the frequency converter is operated with the Control Panel detached, the red LED in the Control Panel mounting platform indicates Fault condition. Table 7-2 contains the Fault messages, their most likely causes and possi-ble remedies. An example of a Fault message is displayed in Figure 7-2.

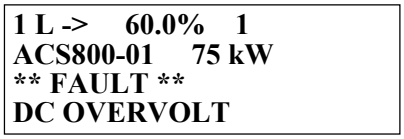

Figure 7-2. A Fault message.

The Fault message is acknowledged by pressing the RESET key or one of the Mode keys. After this the Control Panel operates in the normal way (operational commands on a tripped unit are disabled until the Fault is reset). The last 64 Faults can be viewed in the Fault History (in the Actual Signal Display Mode). Parameter values can be changed if the Fault is caused by incorrect parameter settings. Normal operation can be resumed after the Fault is reset with the RESET key (if not already reset) or from an external control location. After this, the motor can be started with (Start) key. If a Fault persists despite the actions indicated in the remedy column, contact an ABB service representative.

7.3.1 Fault History

When a Fault is detected, it is stored in the Fault History for viewing at a later time. The last 16 Faults are stored in order of appearance along with the time the Fault was detected. The list is automatically updated at each Fault. The Fault History stores the information on all Preprogrammed, Programmable and automatically resetting Faults.

The Fault History does store the DC undervoltage Fault that would be encountered if mains power is shut off during running (e.g. E-stop) if separate supply 24 V is used for RMIO board without using Power On Ackn signal feedback.

The Fault History can be checked for trends that may be useful in preventing future Faults. For example, if there are several overvoltage Faults in the Fault History, there might be an overvoltage problem in the mains system.

The Fault History is entered from the Actual Signal Display Mode by pressing or . The Faults can then be scrolled with and . To exit the Fault History press or .

The Fault History can be cleared by pressing the RESET key.
The Fault History is cleared before shipment from factory. All Faults therein have occurred since shipment.

Table 7-2 The CraneDrive Fault messages

Fault	***Cause***	***Remedy***
ACS 800 TEMP	The ACS 800 internal temperature is excessive. The trip level of inverter module temperature is 140 °C.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
BC OVERHEAT	Brake chopper (internal) overload.	Stop drive. Allow chopper to cool down. Check parameter settings of resistor overload protection function (see parameter group 27 BRAKE CHOPPER). Check that braking cycle meets the allowed limits. Check that the supply AC voltage of the drive is not excessive.
BC SHORT CIR	Short circuit in brake chopper (internal) IGBT(s).	Replace brake chopper. Ensure brake resistor is connected and not damaged.
BRAKE FLT,	A brake fault = missing acknowledgement (during brake release or at normal running) longer than time delay BRAKE FLT TD (Parameter 67.2) will trip the drive.	Check brake contactor operation. Check wiring of digital output Brake Lift (DO1 = default) to contactor. Check wiring of brake acknowledgement to digital input 1.
BR BROKEN	Brake resistor is not connected or it is damaged. The resistance rating of the brake resistor is too high.	Check the resistor and the resistor connection. Check that the resistance rating meets the specification. See the drive hardware manual.
BR OVERHEAT	Overload of the brake resistor.	Stop drive. Allow chopper to cool down. Check parameter settings of resistor overload protection function (see parameter group 27 BRAKE CHOPPER). Check that braking cycle meets the allowed limits. Check that the supply AC voltage of the drive is not excessive.
BR WIRING	Wrong connection of brake resistor or too low resistance value used.	Check resistor connection and resistance value. Ensure brake resistor is not damaged.
CHOPPER FLT	External chopper (NBRA) fault should always disconnect power to the convertor. A digital input e.g. DI4 (“1”=OK) can be connected to monitor the external braking chopper fault contact. Faulty chopper will trip the drive, display fault on panel and give indication to the supervisory system. The chopper fault will also activate the Watchdog output signal, to be used for Emergency stop of crane.	Check external braking chopper (NBRA type). Check wiring from chopper (NO) fault contact to e.g. digital input 4. Check inhibit input on braking chopper. (NC)

Fault	***Cause***	***Remedy***
COMM MODULE	Communication between drive and Fieldbus adapter module not working properly longer than time delay COMM FLT TIME-OUT (Parameter 30.13).	Check Fieldbus adapter and it's connection fibers to RDCO-0x channel 0.
CTRL B TEMP	RMIO control board temperature is lower than -5...0 °C or exceeds +73...82 °C.	Check air flow and fan operation.
DC OVERVOLT	Intermediate circuit DC voltage is excessive. DC overvoltage trip limit is $1.3 \cdot U_{1max}$, where U_{1max} is the maximum value of the mains voltage range. For 400 V units, U_{1max} is 415 V. For 500 V units, U_{1max} is 500 V. The actual voltage in the intermediate circuit corresponding to the mains voltage trip level is 728 Vdc for 400 V units and 877 Vdc for 500 V units.	Check Braking Chopper and Resistor. Check deceleration time parameters. Check mains for static or transient overvoltages.
DC UNDERVOLT	Intermediate circuit DC voltage is not sufficient. This can be caused by a missing mains phase, a blown fuse or a rectifier bridge internal fault. DC undervoltage trip limit is $0.65 \cdot U\ 1min$, where U_{1min} is the minimum value of the mains voltage range. For 400 V and 500 V units, U 1min is 380 V. The actual voltage in the intermediate circuit corresponding to the mains voltage trip level is 334 Vdc.	Check mains supply and fuses. Check DC capacitors for leakage

Fault	*Cause*	*Remedy*
EARTH FAULT (programmable Fault Function 30.11)	The load on the incoming mains system is out of balance. This can be caused by a fault in the motor, motor cable or an internal malfunction.	Check motor. Check motor cable. Check there are no power factor correction capacitors or surge absorbers in the motor cable.
ELECTR SHAFT	The Slave drive in Electrical shaft control has detected a Master-Slave position counter difference above limit set in parameter 73.5 POS ERROR LIMIT.	In Slave drive check parameters 73.2-73.5 setting. Check following settings in Master and Slave drive: 50.1, 69.1-69.5, 70.1 Check group 23 speed controller settings.
ENCODER ERR	Speed measurement fault detected. This can be caused by: - Loose cable connection - Communication timeout to RTAC or NTAC module - Faulty pulse encoder - Diffference (filtered) between internal calculated and measured actual speed is greater than 20% of motor nominal speed - No encoder pulses received (e.g. motor not rotating at start) within time set in par. 50.4 ENCODER DELAY while drive is in current or torque limit	Check settings of Parameter Group 50. Check pulse encoder and it's cabling including Ch A and Ch B phasing. The sign of the signal 2.17 SPEED MEASURED must be the same as int. calculated speed 1.02 MOTOR SPEED when rotating the motor (set parameter 70.3 SPEED FEEDB USED = FALSE during this test). If not, exchange channels A and B. Check connection between the RMIO board and the RTAC module. Check for proper earthing of equipment. Check for highly emissive components nearby.
EXTERNAL FLT (programmable Fault Function 30.3)	There is a fault in one of the external devices. (This information is configured through one of the programmable digital inputs.)	Check external devices for faults. Check EXT FAULT Fault Function parameter (*see c*hapter 6, parameter 30.3).
FOLL FLT	Follower drive is in faulty state (tripped). Indication given in Master drive if M/F ctrl. Macro active.	Check fault text on Follower drive panel.
INV OVERLOAD	If running inverter in overload condition during braking i.e. IGBT overtemp alarm active + >10% braking power + speed >5% for more than 200 ms the drive will trip, display fault on panel and give indication to the supervisory system.	Check Torque and Current limit settings. Check ramp time setting (69.2 - 5) and fieldbus RATE signal Check pulse encoder connections (A and B) to RTAC or NTAC module (if used). Check brake operation.
I/O COMM ERR	Communication error on the control board, channel CH1. Electromagnetic interference.	Check connections of fiber optic cables on RDCO board channel CH1. Check all I/O modules (if present) connected to channel CH1, e.g. their node ID selector switch S1 setting. See I/O Extension Manuals.

Fault	***Cause***	***Remedy***
LINE CONV	Fault in the line side converter (only in ACC811 type drive).	Change the CDP panels monitored device from motor side converter to line side converter, by using DRIVE key on panel (see Table 2-9). Read line side converter fault message. See line side converter manual for fault description.
MAS OSC FLT	If ”next edge” of the communication test bit is not received within a certain time COMTEST FLT TD (Parameter 71.1), the drive will trip.	Check fieldbus adapter and its connection to RDCO-0x channel 0. Check that PLC program connection comm. Test bit from input to output. Check fieldbus wiring.
MF COMM ERR	Master/Follower bus communication not active. Communication test bit not received within time M/F COMM ERR TD (Parameter 72.10) Or in Broadcast mode: Follower has not received any message from Master within 100 ms timeout (can be due to Ch2 configuration change).	Check M/F bus connections and fibres between the Master drive channel 2 and the Follower drive channel 2. Check setting of parameter 72.1 MAST/FOLL MODE: Should be set to “MASTER” in Master drive and set to FOLLOWER” in Follower drive.
MF RUN FLT	Both Master and Follower drive receiving start-order, but only one of the drives are in “Running” state.	Check Setting of parameter 72.9 M/F FAULT TD. Check M/F bus connections and fibres
MOTOR PHASE (programmable Fault Function 30.10)	One of the motor phases is lost. This can be caused by a fault in the motor, the motor cable, a thermal relay (if used) or an internal fault.	Check motor and motor cable. Check thermal relay (if used). Check MOTOR PHASE Fault Function parameters *(see chapter 6*). Passivate this protection.
MOT OVERSP	If the speed exceeds the level determined by MOT OVERSPEED LEV (61.3) then the drive is tripped momentarily.	Check Torque and Current limit settings. Check motor and motor cables. Check pulse encoder connections (A and B) to RTAC module (if used).
MOTOR TEMP (programmable Fault Function 30.4... 30.9)	Motor temperature is too high (or appears to be too high). This can be caused by excessive load, insufficient motor power, inadequate cooling or incorrect start-up data.	Check motor ratings and load. Check start-up data. Check MOTOR TEMP Fault Function parameters (*see c*hapter 6, group 30).
NO COMMUNICATIO N (X)	Panel comm. lost due to RMIO restarted (from 24V supply dip). Or there is no Bus Administrator connected to the CDP panel link.	Press Reset. Check 24V supply quality. Check from the Drive Selection Mode if there is a Bus Administrator connected. If not, *see chapter 2*, for further advice. Check the cabling.
	The selected drive is not present on the panel link. The panel link does not work because of hardware malfunction or problem in cabling.	Go to Drive Selection Mode by pressing **DRIVE**. Press **ENTER**. Set the ID number to 1. Press **ENTER**. If the panel does not communicate with the drive, set the ID number of the drive to 1 as explained in chapter 2. If the above remedies do not help, write down the code from the fault message and contact ABB Service.

Fault	*Cause*	*Remedy*
OVERCURRENT	Output current is excessive. The software overcurrent trip limit is 3.5 · I_{hd} .	Check motor load. Check acceleration time. Check the motor and motor cable. Check there are no power factor correction capacitors or surge absorbers in the motor cable.
OVERFREQ	Motor is turning faster than the highest allowed speed. This can be caused by an incorrectly set minimum/maximum speed, insufficient braking torque or changes in the load when using torque reference. The trip level is 40 Hz over the operating range absolute maximum speed limit (Direct Torque Control mode active) or frequency limit (Scalar Control active). The operating range limits are set by Parameters 20.1 and 20.2 (DTC mode active) or 20.8 and 20.9 (Scalar control active).	Check the minimum/maximum speed settings. Check the adequacy of motor braking torque. Check the applicability of torque control. Check the need for a Braking Chopper and Braking Resistor. Parameter 20.1 must be set to a value not greater than 3000/(number of pole pairs) rpm.
PANEL/DW COM (programmable Fault Function par. 30.2)	The Control Panel or DriveWindow selected as active Local control location for the CraneDrive has ceased communicating.	Check CDP312R Control Panel or DriveWindow-PC connection. Replace Control Panel in the mounting platform. Restart DriveWindow tool. Check PANEL LOSS Fault Function parameter (*see chapter 6, parameter 30.2*).
PPCC LINK	INT board current measurement or communication fault between the RMIO and INT boards. This fault is masked when drive is off (no motor current). This masking can be disabled by setting parameter 97.7=False (passcode=5600 to open group 97).	Check the fibre optic cables connected between RMIO and INT boards. In parallel connected inverters, check also cabling for RPBU board (+ signal 2.28). Check for short circuit in the power stage. This can cause overload of the INT auxiliary power and result in PPCC communication failure.
SHORT CIRCUIT	There is a short-circuit in the motor cable(s) or motor.	Check the motor and motor cable. Check there are no power factor correction capacitors or surge absorbers in the motor cable.
	The output bridge of the converter unit is faulty.	Check output semiconductors and current transducers. If detecting a faulty IGBT, replace also INT board.
SUPPLY PHASE	Intermediate circuit DC voltage is oscillating. This can be caused by a missing mains phase, a blown fuse or a rectifier bridge internal fault. A trip occurs when the DC voltage ripple is 17 per cent of the DC voltage.	Check mains supply unbalance and fuses.

Fault	***Cause***	***Remedy***
THERMAL MODE	The motor thermal protection mode is incorrectly set to DTC for a high-power motor (> 800 A).	Change parameter 30.5 MOT THERM P MODE from DTC to USER MODE (also adjust parameter 30.6).
THERMISTOR (programmable Fault Function 30.4... 30.5)	Motor thermal protection mode selected as THERMISTOR and the temperature is excessive.	Check motor ratings and load. Check start-up data. Check thermistor connections for digital input DI6. Check thermistor cabling.
TORQ FLT	If SPEED ERROR during constant speed is higher than SP DEV LEV (62.2) for a time longer than TORQ FLT TD (62.3) the drive will trip for TORQ FLT.	Check ramp times. Check Torque and Current limit settings. Check Torque monitoring (Group) parameter settings. Check motor and motor cables. Check pulse encoder connections (A and B) to RTAC module (if used).
TORQ PR FLT	If torque proving is not successful, that means torque does not reach the test level within the time TORQ PROV FLT TD (66.2), the drive will trip. (Normally only used if active load, e.g. hoist drive, with pulse encoder feedback.	Check motor and motor cables. Check if setting of parameter 21.2 Control Magnetising time is to low.
USER MACRO	There is no User Macro saved or the file is defective.	Create the User Macro again.

7.4 Maintenance

The ACS 800 requires minimum maintenance. It is recommended that the unit be kept under more close monitoring after the start-up. There is only need for the routine check-up once operations have stabilised.

The following safety instructions should be followed in the maintenance work.

WARNING! The maintenance work should only be undertaken by a qualified electrician. No measurements, parts replacements or other service procedures not described in this manual should be attempted. Disconnect mains power if fault tracing involves work inside the frame, the motor or the motor cable. Wait 5 minutes for the intermediate circuit capacitors to discharge. The ACS 800 can contain dangerous voltages from external control circuits. Exercise appropriate care when working on the unit. Neglecting these instructions can cause physical injury and death.

WARNING! The printed circuit boards contain integrated circuits that are extremely sensitive to electrostatic discharge. Exercise propitiate care when working on the unit to avoid permanent damage to the circuits.

7.4.1 Heatsink

The heatsink fins pick up dust from the cooling air. The rate of pick-up depends on the frequency converter usage and the amount and type of contamination in the ambient air. The heatsink needs regular cleaning to ensure heat dissipation. The ACS 800 can run into overtemperature Warnings and Faults if the heatsink is not cleaned regularly.

In normal environment, the heatsink should be checked and cleaned annually. Frequency converters operating in extreme conditions will need to be cleaned more often. The best cleaning frequency must be tried out experimentally.

The dust should be removed gently with a soft brush if the cleaning is carried out in the same room where the unit is normally operated. Compressed air should not be used for cleaning unless the installation can be taken apart and the cleaning is carried out in another room (or outdoors). Fan rotation should be prevented (in order to prevent bearing wear) when using compressed air for heatsink cleaning.

7.4.2 Fan

The cooling fan minimum lifetime is calculated at about 60 000 hours, but in an average installation the fan is likely to operate considerably longer. The actual lifetime depends on the frequency converter usage and ambient temperature.
The fan is completely sealed and its lifetime cannot be prolonged with cleaning or lubrication. Fan rotation must be prevented when compressed air is used for cleaning heatsink fins.

Fan failure can be predicted by the increasing noise from fan bearings and the gradual rise in the heatsink temperature in spite of heatsink cleaning. If the frequency converter is operated in a critical part of a process, fan replacement is recommended once these symptoms start appearing.

Fan failure will be self-evident due to the overtemperature Warnings and Faults. After the heatsink has cooled it is possible to reset the Warning/Fault and briefly operate the motor in a critical application.

A replacement fan is available from ABB. Do not attempt operation with other than ABB specified spare parts. The fan can be withdrawn by removing the bottom of the frame.

7.4.3 Capacitors

The ACS 800 intermediate circuit employs several electrolytic capacitors. The minimum lifetime of these capacitors is calculated at about 100 000 hours, but in an average installation the capacitors are likely to operate considerably longer. The actual lifetime depends on the frequency converter loading and the ambient temperature.

Capacitor life can be prolonged by lowering the ambient temperature. It is not possible to predict capacitor failure.

Capacitor failure is usually followed by a mains fuse failure or a Fault trip. Contact ABB if capacitor failure is suspected. Replacements are available from ABB. Do not attempt operation with other than ABB specified spare parts.

Relays and Contactors Frames R2 and R3 are fitted with a relay and frame R4 employs a contactor as a part of the charging circuit. The minimum estimated life spans for the relays and contactors are 100,000 and 1,000,000 operations respectively, but in average applications they are likely to operate considerably longer. The need for renewal of these components depends directly on the frequency of charging cycles.

Relay and contactor replacements are available from ABB. Do not attempt operation with other than ABB specified spare parts.

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Appendix A - Complete Parameter and Default Settings

The tables in this appendix list all the actual signals, parameters, and alternative settings for the CraneDrive. Use these tables as reference when you are customizing macros for your CraneDrive application.

Table A-1 Actual Signals.

Signal name	*Short name*	*Range/Unit*	*Fieldbus scaling*
ACTUAL SIGNALS (Group 1)			
1 SPEED ESTIMATED	SP ESTIM	rpm	20000 = par. 69.01
2 MOTOR SPEED FILT	SPEED	rpm	20000 = par. 69.01
3 FREQUENCY	FREQ	Hz	100 = 1 Hz
4 MOTOR CURRENT	CURRENT	A	10 = 1 A
5 MOTOR TORQUE FILT	TORQUE	%	10000 = 100 % of motor nominal torque
6 POWER	POWER	%	1000 = 100 % of motor nominal power (par..99.09)
7 DC BUS VOLTAGE V	DC BUS V	V	1 = 1 V
8 MAINS VOLTAGE	MAINS V	V	1 = 1 V
9 OUTPUT VOLTAGE	OUT VOLT	V	1 = 1 V
10 ACS 800 TEMP	ACS TEMP	%	10 = 1 %
11 APPLICATION MACRO	MACRO	CRANE; M/F CTRL; USER 1 LOAD; USER 2 LOAD	1 = 1 (1 … 6 acc. par. 99.02)
12 SPEED REF	SPEEDREF	rpm	20000 = par. 69.01
13 CTRL LOCATION	CTRL LOC	LOCAL; I/O CTRL; FIELDBUS; M/F CTRL	1 … 4
14 OP HOUR COUNTER	OP HOUR	h	1 = 1 h
15 KILOWATT HOURS	KW HOURS	kWh	1 = 100 kWh
16 IDENTIF RUN DONE	ID RUN	True, False	65535 = True, 0 = False
17 DI7-1 STATUS	DI7-1		1 = 1 (0 … 127)
18 AI1 [V]	AI1 [V]	V	10 = 1 V
19 AI2 [mA]	AI2 [mA]	mA	10 = 1 mA
20 EXT AI1 [V]	EXT AI1	V	10 = 1 V
21 RO3-1 STATUS	RO3-1		1 = 1 (0 … 7)
22 AO1 [mA]	AO1 [mA]	mA	10 = 1 mA
23 AO2 [mA]	AO2 [mA]	mA	10 = 1 mA
24 TOTAL INERTIA	INERTIA	kgm^2	10 = 1 kgm2
25 EXT DI6-1 STATUS	EXT DI6-1		1 = 1 (0 … 63)
26 EXT RO4-1 STATUS	EXT RO4-1		1 = 1 (0 … 15)
27 MOTOR RUN-TIME	RUN-TIME	h (Hours)	1 = 10 h
28 MOTOR TEMP EST	MOT TEMP	C (deg Celcius)	1 = 1 deg C
29 CTRL BOARD TEMP	CTRL B T	C (deg Celcius)	1 = 1 deg C
30 FAN ON TIME	FAN TIME	h	1 = 10 h
31 AI3 [mA]	AI3 [mA]	mA	10 = 1 mA
32 TOTAL OPER TIME	OPERTIME	hrs	10 = 1 h
33 LOAD TORQUE ton	LOAD ton	ton	100 = 1 ton
34 LOAD SPEC FACT Km	FACT Km		100 = 1
35 LIFETIME LEFT %	LIFETIME	%	1 = 1 %

Signal name	*Range/Unit*	*Description*	*Fieldbus scaling*
INT SIGNALS (Group 2)			
1 SPEED REF 2	rpm	Ramp input reference limited by speed limits (parameters 20.1 & 20.2)	20000 = par. 69.01
2 SPEED REF 3	rpm	Ramp output reference	20000 = par. 69.01
3 SPEED REF 4	rpm	Total speed reference = ramp output reference + speed correction reference	20000 = par. 69.01
4 SPEED ERROR NEG	rpm	Actual speed - total speed reference	20000 = par. 69.01
5 TORQUE PROP REF	%	Speed controller proportional part output	10000 = 100 % of motor nominal torque
6 TORQUE INTEG REF	%	Speed controller integration part output	10000 = 100 % of motor nominal torque
7 TORQUE DER REF	%	Speed controller derivative part output	10000 = 100 % of motor nominal torque
8 TORQ ACC COMP REF	%	Acceleration compensation reference	10000 = 100 % of motor nominal torque
9 TORQUE REF1	%	Torque reference input to drive (torque ramp output)	10000 = 100 % of motor nominal torque
10 TORQUE REF2	%	Speed controller total output + acceleration compensation reference. Limited with parameters 20.4 & 20.5	10000 = 100 % of motor nominal torque
11 TORQUE REF3	%	Output of “Torque Selector”, see parameter 72.2	10000 = 100 % of motor nominal torque
12 TORQUE REF4	%	Torque ref 3 + Load compensation	10000 = 100 % of motor nominal torque
13 TORQUE REF	%	Torque ref 4 + Torque step	10000 = 100 % of motor nominal torque
14 TORQ USED REF	%	Final torque reference used by torque controller (Torque ref 5 with limits)	10000 = 100 % of motor nominal torque
15 MOTOR TORQUE	%	Actual motor torque	10000 = 100 % of motor nominal torque
16 FLUX ACT	%	Actual motor flux	1000 = 100 %
17 SPEED MEASURED	Rpm	Measured (RTAC or NTAC) motor speed	20000 = par. 69.01
18 POS ACT PPU	+/- 32767	Position measurement value (scaled with parameter 70.1)	1 = 1
19 START	True; False	Start-order (Local or External)	65535 = True, 0 = False
20 RUNNING	True; False	Drive running acknowledgment	65535 = True, 0 = False
21 BRAKE LIFT	True; False	Brake lift order	65535 = True, 0 = False
22 FAULT	True; False	Drive fault indication (tripped)	65535 = True, 0 = False
23 “not used”			
24 SPEED CORR	Rpm	Speed correction reference	1 = 1 rpm
25 POWOP SPEEDREF	%	Power optimisation calculated speed reference (enabled with “High speed” signal)	1000 = 100 %
26 ELSHAFT POS ERROR		Electric Shaft control position error in Slave drive (Slave Posact – Master Posact). Scaling according to parameter 70.1 POS SCALE setting.	1 = 1
27 LIMIT WORD 1	0 – FFFF Packed boolean (Hex)	Limit word indicating if drive is running in any limitation, For bit details see section 4.3	1 = 1 (0 … 65535)
28 FAULTED INT INFO	0 – FFFF Packed boolean (Hex)	INT board fault info, For bit details see section 4.3	1 = 1 (0 … 65535)
29 TORQUE SELECTOR	ZERO; SPEED; TORQUE; MIN; MAX; ADD	Torque reference (2.11) selector setting used: 0 = Zero control (not used in CraneDrive) 1 = Speed control (Torq ref 2) 2 = Torque control (Torq ref 1) 3 = Minimum control (min of Torq ref 1 and 2) 4 = Maximum control (max of Torq ref 1 and 2) 5 = Add control (sum of Torq ref 1 and 2)	1 = 1 (0 … 5)
30 dV/dt	rpm/s	Speed reference ramp derivative	20000 = par. 69.01
31 LOAD TORQUE %	% Tn (Integer scaling: 10=1%)	Calculated load torque in % of motor nominal torque (filtered with par. 68.10)	1000 = 100 %
32 LIMIT WORD INV	0 – FFFF Packed boolean (Hex)	Limit word indicating details if bit 4 in TORQ INV CUR LIM of 2.27 Limit Word 1 is set. For bit details see section 4.3	1 = 1 (0 … 65535)
33 INT SC INFO	0 – FFFF Packed boolean (Hex)	Information word on location of Short circuit fault. For bit details see section 4.3	1 = 1 (0 … 65535)

Signal name	*Range/Unit*	*Description*	*Fieldbus scaling*
FB REC WORDS (Group 3)			
1 FB COMMAND WORD	0 – FFFF Packed boolean (Hex)	Fieldbus Command Word, Dataset 1 Word 1, For bit details see section 5.6.12	1 = 1 (0 … 65535)
2 FB SPEED REF	%	Fieldbus Speed Reference, Dataset 1 Word 2	10000 = 100 %
3 FB TORQ REF	%	Fieldbus Torque Reference, Dataset 1 Word 3	10000 = 100 %
4 FB RAMP RATE		Fieldbus Ramp rate, Dataset 3 Word 1, see table 5-5 for details.	1000 = 1
5 FB SPEED CORR	%	Fieldbus Speed Correction reference, Dataset 3 Word 2	10000 = 100 %
6 FB POS PRECOUNT	(mm)	Fieldbus Position Precount value, Dataset 3 Word 3	1 = 1
7 FB AUX COMM WORD	0 – FFFF Packed boolean (Hex)	Fieldbus Aux Command Word, Dataset 5 Word 1, For bit details see section 5.6.12	1 = 1 (0 … 65535)
8 FB LOAD MEAS REF	%	Fieldbus Load Measure Reference, Dataset 5 Word 2 (or PLC signal to DW)	10000 = 100 %
9 FB DS5 WORD3	0 – FFFF Packed boolean (Hex)	Fieldbus Dataset 5 Word 3 (For boolean PLC signals to DriveWindow, 8 ms updating time)	1 = 1 (0 … 65535)
10 FB DS7 WORD1	Integer +/- 32767	Fieldbus Dataset 7 Word 1, see section 6.2.29 for details (or PLC signal to DW)	1 = 1 (-32768 … 32767)
11 FB DS7 WORD2	Integer +/- 32767	Fieldbus Dataset 7 Word 2, see section 6.2.29 for details (or PLC signal to DW)	1 = 1 (-32768 … 32767)
12 FB DS7 WORD3	Integer +/- 32767	Fieldbus Dataset 7 Word 3, see section 6.2.29 for details (or PLC signal to DW)	1 = 1 (-32768 … 32767)

Signal name	*Range/Unit*	*Description*	*Fieldbus scaling*
FB TRA WORDS (Group 4)			
1 FB STATUS WORD	0 – FFFF Packed boolean (Hex)	Fieldbus Status Word, Dataset 2 Word 1, For bit details see section 5.6.12	1 = 1 (0 … 65535)
2 FB FAULT WORD 1	0 – FFFF Packed boolean (Hex)	Fieldbus Fault Word 1, Dataset 6 Word 1, For bit details see section 5.6.12	1 = 1 (0 … 65535)
3 FB FAULT WORD 2	0 – FFFF Packed boolean (Hex)	Fieldbus Fault Word 2, Dataset 6 Word 2, For bit details see section 5.6.12	1 = 1 (0 … 65535)
4 FB ALARM WORD	0 – FFFF Packed boolean (Hex)	Fieldbus Alarm Word, Dataset 6 Word 3, For bit details see section 5.6.12	1 = 1 (0 … 65535)
5 FB AUX STATUSWORD	0 – FFFF Packed boolean (Hex)	Fieldbus Aux Status Word, Dataset 12 Word 1, For bit details see section 5.6.12	1 = 1 (0 … 65535)

Signal name	*Range/Unit*	*Description*
INFORMATION (Group 5)		
1 SW PACKAGE VER	e.g. ACXR7100	Version of the complete ACC 800 software package
2 APPLIC SW VERSION	e.g. ACAR7100	Version of the ACC 800 application software
3 TEST DATE	ddmmyy (Day Month Year)	Converter factory test date
4 INVERTER TYPE	e.g. SR0040_3	ACS800 Converter type
5 ACS800 -	CraneDrive	ACS800 Application type

Table A-2 Parameter Settings.

Parameter	*Alternative Settings*	*Default setting*	*Fieldbus scaling*
99 START-UP DATA			
99.1 LANGUAGE	ENGLISH; ENGLISH AM; DEUTSCH; ITALIANO; ESPANOL; PORTUGUES; NEDERLANDS; FRANCAIS; DANSK; SUOMI; SVENSKA; CESKY; POLSKI; PO-RUSSKI	ENGLISH	1 = 1 (0 … 13)
99.2 APPLICATION MACRO	CRANE; M/F CTRL; USER 1 LOAD; USER 1 SAVE; USER 2 LOAD; USER 2 SAVE	CRANE	1 = 1 (1 … 6)
99.3 APPLIC RESTORE	NO; YES	NO	0 = NO 65535 = YES
99.4 MOTOR CTRL MODE	DTC; SCALAR	DTC	0 = DTC 65535=SCALAR
99.5 MOTOR NOM VOLTAGE	½ * U_N of ACS 800 ... 2 * U_N of ACS 800 (printed on the motor nameplate)	0 V	1 = 1 V
99.6 MOTOR NOM CURRENT	1/6 * I_{hd} of ACS 800 ... 2 * I_{hd} of ACS 800 (printed on the motor nameplate)	0.0 A	10 = 1 A
99.7 MOTOR NOM FREQ	8 Hz ... 300 Hz (printed on the motor nameplate)	50.0 Hz	100 = 1 Hz
99.8 MOTOR NOM SPEED	1 rpm ... 18 000 rpm (printed on the motor nameplate)	1 rpm	1 = 1 rpm
99.9 MOTOR NOM POWER	0 kW ... 9000 kW (printed on the motor nameplate)	0.0 kW	10 = 1 kW
99.10 MOTOR ID RUN	ID MAGN; STANDARD; REDUCED	ID MAGN	1 = 1 (1 … 3)
99.11 DEVICE NAME	Drive section name, e.g. “Main Hoist”		
10 DIGITAL INPUTS			
10.1 BRAKE ACKN SEL	INTERNAL ACK; DI1; DI2; DI5; DI6; DI_IL	DI1	1 = 1 (1 … 6)
10.2 ZERO POS SEL	NOT SEL; DI1; DI2; DI5; DI6; DI_IL	DI2	1 = 1 (1 … 6)
10.3 SLOWDOWN-N SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; DI5+DI6; DI1.1+DI1.2; DI_IL	DI5	1 = 1 (1 … 12)
10.4 FAST STOP-N SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; DI_IL	DI6	1 = 1 (1 … 10)
10.5 POWER ON ACKN SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; EXT DI1.3; EXT DI2.3; DI_IL	NOT SEL	1 = 1 (1 … 12)
10.6 SYNC SEL	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; DI_IL	NOT SEL	1 = 1 (1 … 12)
10.7 CHOPPER FLT-N SEL	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; DI_IL	NOT SEL	1 = 1 (1 … 12)
10.8 STEP REF2 SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; DI1.3; DI2.3; DI_IL	NOT SEL	1 = 1 (1 … 12)
10.9 STEP REF3 SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; DI1.3; DI2.3; DI_IL	NOT SEL	1 = 1 (1 … 12)
10.10 STEP REF4 SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; DI1.3; DI2.3; DI_IL	NOT SEL	1 = 1 (1 … 12)
10.11 HIGH SPEED SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; DI_IL	NOT SEL	1 = 1 (1 … 10)
10.12 SNAG LOAD-N SEL	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6; DI_IL	NOT SEL	1 = 1 (1 … 8)
10.13 ACCELERATE SEL	NOT SEL; DI1; DI2; DI5; DI6; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; DI_IL	NOT SEL	1 = 1 (1 … 10)
10.14 FB STOPLIM SEL	NOT SEL; DI3+DI4; DI5+DI6; DI1.1+DI1.2	NOT SEL	1 = 1 (1 … 4)
10.15 ELSHAFT ON SEL	NOT SEL; DI1; DI2; EXT DI1.1; EXT DI1.2; EXT DI2.1; EXT DI2.2; EXT DI1.3; EXT DI2.3; DI5; DI6; DI_IL	NOT SEL	1 = 1 (1 … 12)
10.16 FAULT RESET SEL	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6; DI_IL	NOT SEL	1 = 1 (1 … 8)
10.17 USER MACRO CH SRC	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6; COMM MODULE; DI_IL	NOT SEL	1 = 1 (1 … 9)
10.18 EXTERNAL FAULT	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6; DI_IL	NOT SEL	1 = 1 (1 … 8)
13 ANALOGUE INPUTS			
13.1 SCALE AI1	0 ... 4.000	1.000	1000 = 1
13.2 FILTER AI1	0 s ... 4.00 s	0.02 s	100 = 1 s
13.3 SCALE AI2	0 ... 4.000	1.000	1000 = 1
13.4 FILTER AI2	0 s ... 4.00 s	0.02 s	100 = 1 s
13.5 SCALE EXT AI1	0 ... 4.000	0.000	1000 = 1
13.6 FILTER EXT AI1	0 s ... 4.00 s	0.02 s	100 = 1 s
13.7 AI1 0% REF LEV	0.0 ... 10.0 V	0.0 V	10 = 1 V
14 RELAY OUTPUTS			
14.1 RELAY RO1 OUTPUT	NOT USED; READY; RUNNING; FAULT; FAULT-N; CONTROL LOC; BRAKE LIFT; WATCHDOG-N; USER 1 OR 2; REVERSE; OVERSPEED; RDY FOR RUN; SPEED LIM 1; LIFETIME>90%	BRAKE LIFT	1 = 1 (1 … 14)
14.2 RELAY RO2 OUTPUT	See 14.1	WATCHDOG-N	1 = 1 (1 … 14)
14.3 RELAY RO3 OUTPUT	See 14.1	FAULT-N	1 = 1 (1 … 14)
14.4 EXT1 DO1 OUTPUT	See 14.1	NOT USED	1 = 1 (1 … 14)
14.5 EXT1 DO2 OUTPUT	See 14.1	NOT USED	1 = 1 (1 … 14)
14.6 EXT2 DO1 OUTPUT	See 14.1	NOT USED	1 = 1 (1 … 14)
14.7 EXT2 DO2 OUTPUT	See 14.1	NOT USED	1 = 1 (1 … 14)

Parameter	*Alternative Settings*	*Default setting*	*Fieldbus scaling*
15 ANALOGUE OUTPUTS			
15.1 ANALOGUE OUTPUT1	NOT USED; MEAS SPEED; SPEED; FREQUENCY; CURRENT; SIGN TORQUE; POWER; DC BUS VOLT; OUTPUT VOLT; SIGN POSACT; SIGN SP REF	SPEED	1 = 1 (1 … 11)
15.2 INVERT AO1	NO; YES	NO	0 = NO 65535 = YES
15.3 MINIMUM AO1	0 mA; 4 mA	0 mA	1 = 0 mA 2 = 4 mA
15.4 FILTER ON AO1	0.00 s ... 10.00 s	0.10 s	100 = 1 s
15.5 SCALE AO1	10 % ... 1000 %	100%	1 = 1 %
15.6 ANALOGUE OUTPUT2	NOT USED; SIGN SPEED; SPEED; FREQUENCY; CURRENT; TORQUE; POWER; DC BUS VOLT; OUTPUT VOLT; TORQUE REF; SIGN SP REF	TORQUE	1 = 1 (1 … 11)
15.7 INVERT AO2	NO; YES	NO	0 = NO 65535 = YES
15.8 MINIMUM AO2	0 mA; 4 Ma	0 mA	1 = 0 mA 2 = 4 mA
15.9 FILTER ON AO2	0.00 s ... 10.00 s	2.00 s	100 = 1 s
15.10 SCALE AO2	10 % ... 1000 %	100%	1 = 1 %
16 SYST CTR INPUTS			
16.2 PARAMETER LOCK	OPEN; LOCKED	OPEN	0 = OPEN 65535 = LOCKED
16.3 PASS CODE	0 ... 30 000	0	1 = 1
16.8 FAN SPD CTRL MODE	CONST 50HZ; RUN/STOP; CONTROLLED	CONST 50HZ	1 = 1 (0 … 2)
16.9 FUSE SWITCH CNTR	OFF; ON	OFF	0 = OFF 65535 = ON
16.10 INT CONFIG USER	0 … Int config (number of R8i modules configured in drive)	"Int config"	1 = 1 (0 … 12)
20 LIMITS			
20.1 MINIMUM SPEED	- 18 000/(number of pole pairs) rpm ... MAXIMUM SPEED (value of par. 20.2)	(calculated)	20000 = p.69.1
20.2 MAXIMUM SPEED	MINIMUM SPEED (value of par. 20.1) ... 18 000/(number of pole pairs) rpm	(calculated)	20000 = p.69.1
20.3 MAXIMUM CURRENT A	0.00 Amp ... I_{max} Amp	I_{max} Amp	10 = 1 A
20.4 MAXIMUM TORQUE	0.0 % ... 600.0 %	200.0 %	100 = 1 %
20.5 MINIMUM TORQUE	-600.0 % … 0.0 %	-200.0 %	100 = 1 %
20.6 OVERVOLTAGE CTRL	ON; OFF	OFF	0 = OFF 65535 = ON
20.7 UNDERVOLTAGE CTRL	ON; OFF	ON	0 = OFF 65535 = ON
20.8 MINIMUM FREQ	- 300.00 Hz ... MAXIMUM FREQ Hz (value of par 20.9) (Visible if Scalar mode)	-50.00 Hz	100 = 1 Hz
20.9 MAXIMUM FREQ	MINIMUM FREQ Hz (value of par 20.8) ... 300.00 Hz (Visible if Scalar mode)	50.00 Hz	100 = 1 Hz
20.10 SPEED LIMIT AI3	0.0 % ... 100.0 %	100.0 %	10 = 1 %
20.11 P MOTORING LIM	0.0 % ... 600.0 %	300.0 %	100 = 1 %
20.12 P GENERATING LIM	-600.0 % … 0.0 %	-300.0 %	100 = 1 %
20.13 TORQ RISE T LIM	0.0 % … "max" % (max depends on inverter & motor size combination)	"max" %	100 = 1 %
21 START/STOP			
21.1 START FUNCTION	CNST DC MAGN	CNST DC MAGN	3 = CONST DC MAGN
21.2 CONST MAGN TIME	30.0 ms ... 10000.0 ms	500.0 ms	1 = 1 ms
23 SPEED CTRL			
23.1 GAIN	0.0 ... 200.0	10.0	100 = 1.0
23.2 INTEGRATION TIME	0.01 s ... 1000.00 s	2.50 s	1000 = 1 s
23.3 DERIVATION TIME	0.0 ms ... 9999.8 ms	0.0 ms	1 = 1 ms
23.4 ACC COMPENSATION	0.00 s ... 1000.00 s	0.00 s	10 = 1 s
23.5 SLIP GAIN	0.0 % ... 400.0 %	100.0%	1 = 1 %
23.6 AUTOTUNE RUN ?	NO; YES	NO	0 = NO 65535 = YES
23.7 FEEDB FILTER TIME	0.0 ... 999.9 ms	4.0 ms	1 = 1 ms
23.8 SPEED STEP (only for DW)	-1500.00 … 1500.00 rpm	0.00 rpm	20000 = p.69.1
24 TORQUE CTRL	(not visible if par 72.1 MAST/FOLL MODE = FOLLOWER)		
24.1 TORQ RAMP UP	0.00 s ... 120.00 s	0.00 s	100 = 1 s
24.2 TORQ RAMP DOWN	0.00 s ... 120.00 s	0.00 s	100 = 1 s
24.3 TORQ STEP (only for DW)	-300.00 … 300.00 %	0.00 %	100 = 1 %
26 MOTOR CONTROL	(visible only when the "SCALAR motor control mode" is selected)		
26.3 IR COMPENSATION	0 % ... 30 % (visible only when the "SCALAR motor control mode" is selected)	0%	100 = 1 %

Parameter	*Alternative Settings*	*Default setting*	*Fieldbus scaling*
27 BRAKE CHOPPER			
27.1 BRAKE CHOPPER CTL	OFF; ON	OFF (R2&R3=ON)	0 = OFF 65535 = ON
27.2 BR OVERLOAD FUNC	NO; WARNING; FAULT	NO	1 = 1 (0 … 2)
27.3 BR RESISTANCE	0.01 … 100.00 ohm	100.00 ohm	1 = 1 ohm
27.4 BR THERM TCONST	0.000 … 10000.000 s	0.000 s	1 = 1 s
27.5 MAX CONT BR POWER	0.00 … 10000.00 kW	0.00 kW	1 = 1 Kw
27.6 BC CTRL MODE	AS GENERATOR; COMMON DC	AS GENERATOR	0 = AS GENERATOR 65535 = COMMON DC
28 MOTOR MODEL			
28.1 LONG DISTANCE MOD	OFF; ON	OFF	0 = OFF 65535 = ON
28.2 TR TUNE	-60.0 % … +200.0 %	0.0 %	1 = 1 %
30 FAULT FUNCTIONS			
30.2 PANEL LOSS	FAULT; NO	FAULT	1 = 1 (1 … 2)
30.4 MOTOR THERM PROT	FAULT; WARNING; NO	FAULT	1 = 1 (1 … 3)
30.5 MOT THERM P MODE	DTC; USER MODE; THERMISTOR	DTC	1 = 1 (1 … 3)
30.6 MOTOR THERM TIME	256.0 s ... 9999.8 s	(calculated)	1 = 1 s
30.7 MOTOR LOAD CURVE	50.0 % ... 150.0 %	100.0 %	1 = 1 %
30.8 ZERO SPEED LOAD	25.0 % ... 150.0 %	74.0 %	1 = 1 %
30.9 BREAK POINT	1.0 Hz ... 300.0 Hz	45.0 Hz	100 = 1 Hz
30.10 MOTOR PHASE LOSS	NO; FAULT	FAULT	0 = NO 65535 = FAULT
30.11 EARTH FAULT	NO; FAULT	FAULT	0 = NO 65535 = FAULT
30.12 MASTER FAULT FUNC	FAULT; NO; WARNING (visible only when COMM MODULE is selected)	FAULT	1 = 1 (1 … 3)
30.13 COMM FLT TIME-OUT	0.10 ... 60.00 s (visible only when COMM MODULE is selected)	1.00 s	100 = 1 s
50 PULSE-ENCODER	(Only visible when ENCODER MODULE is selected, par. 98.1)		
50.1 ENCODER PULSE NR	1000 – 4096	1024	1 = 1
50.2 SPEED MEAS MODE	A_-B DIR; A_-_; A_-_B DIR; A_-_ B_-_	A_-_ B_-_	1 = 1 (0 … 3)
50.3 ENCODER ALM/FLT	WARNING; FAULT	FAULT	0 = WARNING 65535 = FAULT
50.4 ENCODER DELAY	5 ms ... 50000 ms	1000 ms	1 = 1 ms
50.5 SPEED FEEDB USED	True; False	True	0 = False 65535 = True
51 COMM MODULE	(Only visible when par. 98.2 selected to COMM MODULE)		
51.1 MODULE TYPE	(Fieldbus module type connected)	(module type)	See module manual
51.2 ... 51.15	(Fieldbus module parameters per connected type of module)		See module manual
60 LOCAL OPERATION			
60.1 LOC OPER INH	True; False	False	0 = False 65535 = True
60.2 LOC SPEED MAX	0.0 % ... 100.0 %	10.0 %	10 = 1 %
60.3 LOC ZERO SPEED TD	0.0 s ... 300.0 s	120.0 s	10 = 1 s
61 SPEED MONITOR			
61.3 MOT OVERSPEED LEV	0 ... 200 %	110 %	1 = 1 %
61.4 SPEED LIM 1	0.0 ... 200.0 %	20.0 %	10 = 1 %
62 TORQUE MONITOR			
62.1 TORQ MON SEL	True; False	True	0 = False 65535 = True
62.2 SP DEV LEV	0...100 %	10 %	1 = 1 %
62.3 TORQ FLT TD	0...60000 ms	600 ms	1 = 1 ms
62.4 SP DER BLK LEV	0...100 %/s	13 %/s	1 = 1 %/s
63 FAST STOP			
63.1 FAST STOP TYPE 11	NOT USED; FAST STOP 1; FAST STOP 2; FAST STOP 3	NOT USED	1 = 1 (0 … 4)
63.2 FAST STOP TYPE 12	NOT USED; FAST STOP 1; FAST STOP 2; FAST STOP 3	NOT USED	1 = 1 (0 … 4)

Parameter	*Alternative Settings*	*Default setting*	*Fieldbus scaling*
64 CRANE			
64.1 STAND ALONE SEL	True; False	True	0 = False 65535 = True
64.2 CONTIN GEAR	True; False	False	0 = False 65535 = True
64.3 HIGH SPEED LEVEL 1	0.0 % ... 100.0 %	98.0 %	10 = 1 %
64.4 DEADZONE A	0.0 % ... 100.0 %	0.0 %	10 = 1 %
64.5 DEADZONE B	0.0 % ... 100.0 %	0.0 %	10 = 1 %
64.6 REF SHAPE	0 ... 100	20	1 = 1
64.7 SLOWDOWN SPEEDREF	0 % ... 100 %	25 %	1 = 1 %
64.8 ZERO POS OK TD	0.0 s ... 60.0 s	0.3 s	10 = 1 s
64.9 TORQUE REF SCALE	0 ... 4.00	1.00	100 = 1.0
64.10 CONTROL TYPE	JOYSTICK; RADIO CTRL; MOTOR POT; STEP JOYST; STEP RADIO; FB JOYSTICK	JOYSTICK	1 = 1 (0 … 6)
64.11 MINIMUM REF	0.0 % ... 100.0 %	0.0 %	10 = 1 %
64.12 JOYSTICK WARN TD	0 ms ... 5000 ms	400 ms	1 = 1 ms
64.13 STEP REF LEVEL 1	0.0 % ... 100.0 %	10.0 %	10 = 1 %
64.14 STEP REF LEVEL 2	0.0 % ... 100.0 %	25.0 %	10 = 1 %
64.15 STEP REF LEVEL 3	0.0 % ... 100.0 %	50.0 %	10 = 1 %
64.16 STEP REF LEVEL 4	0.0 % ... 100.0 %	100.0 %	10 = 1 %
65 LOGIC HANDLER			
65.1 CONTIN ON	True; False	False	0 = False 65535 = True
65.2 OFF TD	0.0 s ... 10000.0 s	180.0 s	10 = 1 s
66 TORQUE PROVING			
66.1 TORQ PROV SEL	True; False	False	0 = False 65535 = True
66.2 TORQ PROV FLT TD	0.0 s ...100.0 s	0.5 s	10 = 1 s
66.3 TORQ PROV REF	0.0 % ... 200.0 %	20.0 %	10 = 1 %
67 MECH BRAKE CONT			
67.1 BRAKE FALL TIME	0.0 s ... 60.0 s	1.0 s	10 = 1 s
67.2 BRAKE FLT TD	0.0 s ... 60.0 s	1.0 s	10 = 1 s
67.4 BRAKE REOPEN TD	0.0 s ... 60.0 s	0.0 s	10 = 1 s
67.5 BRAKE LONG FT TD	0.0 s ... 60.0 s	0.5 s	10 = 1 s
67.6 ZERO SPEED LEV	0.0 % ... 100.0 %	1.0 %	10 = 1 %
67.7 ZERO SPEED TIME	0 ... 1000 ms	200 ms	1 = 1 ms
67.8 SPEED REF TD	0.00 s ... 10.00 s	0.20 s	100 = 1 s
67.9 START TORQ SEL	NOT USED; AUTO TQ MEM; LOAD MEAS; PAR 67.10	NOT USED	1 = 1 (0 … 4)
67.10 MIN START TQ REF	0 … 300 %	0 %	1 = 1 %
67.11 MOTOR TYPE	STANDARD; CONICAL	STANDARD	0 = STANDARD 65535 = CONICAL
67.12 RED FLUX LEVEL	25 ... 100 % (visible only if par. 67.11 selected to CONICAL)	75 %	1 = 1 %
67.13 START FLUX LEVEL	100 ... 140 % (visible only if par. 67.11 selected to CONICAL)	100 %	1 = 1 %
67.14 START FLUX TIME	0.0 ... 10.0 s (visible only if par. 67.11 selected to CONICAL)	1.0 s	10= 1 s
68 POWER OPTIMIZE			
68.1 POWOP SELECT	True; False	False	0 = False 65535 = True
68.2 BASE SPEED	1.0 % ... 100.0 %	100.0 %	10 = 1 %
68.3 POWOP AUTOTUNE SEL	True; False	False	0 = False 65535 = True
68.4 INERTIA TOTAL UP	0.00 kgm2 ... 100.00 kgm2	3.00 kgm2	100 = 1 kgm2
68.5 INERTIA TOTAL DWN	0.00 kgm2 ... 100.00 kgm2	30.00 kgm2	100 = 1 kgm2
68.6 TQLIM UP	0.0 % ... 200.0 %	100.0 %	10 = 1 %
68.7 TQLIM DWN	0.0 % ... 200.0 %	75.0 %	10 = 1 %
68.8 POWOP RESET LEV	0 % ... 100 %	12 %	1 = 1 %
68.9 T MAX	0% … 2000%	500 %	1 = 1 %
68.10 LOAD TORQ FILT TC	0 ms ... 32000 ms	150 ms	1 = 1 ms
68.11 SLACK ROPE TQ LEV	-400 % ... 400 %	-400 %	1 = 1 %
68.12 LOADCORR FACT UP	0.00 ... 100.00	0.90	100 = 1.0
68.13 LOADCORR FACT DWN	0.00 ... 100.00	1.10	100 = 1.0

Parameter	*Alternative Settings*	*Default setting*	*Fieldbus scaling*
69 REFERENCE HANDLER			
69.1 SPEED SCALING RPM	0 rpm ... 10000 rpm	1500 rpm	1 = 1 rpm
69.2 ACC TIME FORW	0.1 s ... 60.0 s	5.0 s	10 = 1 s
69.3 ACC TIME REV	0.1 s ... 60.0 s	5.0 s	10 = 1 s
69.4 DEC TIME FORW	0.1 s ... 60.0 s	5.0 s	10 = 1 s
69.5 DEC TIME REV	0.1 s ... 60.0 s	5.0 s	10 = 1 s
69.6 S-RAMP TC	0.0 s ... 10.0 s	0.0 s	10 = 1 s
69.7 RAMP SCALE LOCAL	0.5 ... 100.0	2 .0	10 = 1.0
69.10 RAMP RATE=1	True; False; AI3	True	1 = 1 (1 … 3)
70 POS MEASURE			
70.1 POS SCALE	1.00 ... 32767.00 PPU	100.00 PPU	100 = 1 ppu
70.2 SYNC COND	Pos; Neg	Pos	0 = Pos 65535 = Neg
71 FIELD BUS COMM			
71.1 COMTEST FLT TD	0 ms ... 32767 ms	300 ms	1 = 1 ms
71.2 RESET POWER ON TD	0 ms ... 32767 ms	2000 ms	1 = 1 ms
71.3 CHOPP/EXT MON TD	0 ms ... 4000 ms	1000 ms	1 = 1 ms
71.4 ADVANT COMM TYPE	ENG DRIVE; STD DRIVE	ENG DRIVE	0 = ENG DRIVE 65535 = STD DRIVE
71.5 DSET BASE ADDRESS	1; 10	1	0 = 1 65535 = 10
71.6 FIELDBUS R-TYPE	NO; RPBA-01	NO	1 = 1 (1 … 2)
72 MASTER / FOLLOWER			
72.1 MAST/ FOLL MODE	OFF; MASTER; FOLLOWER (visible only if M/F CTRL macro selected)	OFF	1 = 1 (1 … 3)
72.2 TORQUE SELECTOR	ZERO; SPEED; TORQUE; MINIMUM; MAXIMUM; ADD	ZERO	1 = 1 (1 … 6)
72.3 LOAD SHARE	0.0 % ... 400.0 % (visible only if M/F CTRL macro selected)	100.0 %	10 = 1 %
72.4 WINDOW SEL ON	OFF; ON	OFF	0 = OFF 65535 = ON
72.5 WINDOW WIDTH POS	0.0 rpm ... 1500.0 rpm	0.0 rpm	20000 = p.69.1
72.6 WINDOW WIDTH NEG	0.0 rpm ... 1500.0 rpm	0.0 rpm	20000 = p.69.1
72.7 DROOP RATE	0.0 % ... 100.0 %	0.0 %	10 = 1 %
72.8 TORQ REF A FTC	0 ms ... 32767 ms (visible only if M/F CTRL macro selected)	0 ms	1 = 1 ms
72.9 M/F FAULT TD	0 ms ... 32767 ms (visible only if M/F CTRL macro selected)	200 ms	1 = 1 ms
72.10 M/F COMM ERR TD	0 ms ... 32767 ms (visible only if M/F CTRL macro selected)	200 ms	1 = 1 ms
72.11 MF BROADCAST MODE	NO; YES	NO	0 = NO 65535 = YES
73 ELECTRIC SHAFT			
73.1 ELSHAFT MODE SEL	OFF; MASTER; SLAVE	OFF	1 = 1 (1 … 3)
73.2 ELSHAFT GAIN	0.0 … 100.0 (only used in Slave)	0.1	100 = 1.0
73.3 GEAR NUMERATOR	1 … 32000 (only used in Slave)	1	1 = 1
73.4 GEAR DENOMINATOR	1 … 32000 (only used in Slave)	1	1 = 1
73.5 POS ERROR LIMIT	0 … 1000 (only used in Slave)	10	1 = 1
73.6 ELSH CTRL MIN SPD	0 … 100 % (only used in Slave)	20 %	1 = 1 %
74 CRANE LIFETIME			
74.1 NOMINAL LOAD	0.00 … 32767.00 ton	0.00 ton	100 = 1 ton
74.2 CRANE LIFETIME	0 … 12500 hrs	100 hrs	1 = 1 hr
74.3 START LIFETIMEMON	OFF; ON	OFF	0 = OFF 65535 = ON

Parameter	*Alternative Settings*	*Default setting*	*Fieldbus scaling*
90 DATASET REC ADDR			
90.1 DATASET 7 WORD 1	0 … 9999	0	1 = 1
90.2 DATASET 7 WORD 2	0 … 9999	0	1 = 1
90.3 DATASET 7 WORD 3	0 … 9999	0	1 = 1
92 DATASET TR ADDR			
92.1 DATASET 4 WORD 1	0 … 9999	202	1 = 1
92.2 DATASET 4 WORD 2	0 … 9999	218	1 = 1
92.3 DATASET 4 WORD 3	0 … 9999	104	1 = 1
92.4 DATASET 6 WORD 1	0 … 9999	402	1 = 1
92.5 DATASET 6 WORD 2	0 … 9999	403	1 = 1
92.6 DATASET 6 WORD 3	0 … 9999	404	1 = 1
92.7 DATASET 8 WORD 1	0 … 9999	109	1 = 1
92.8 DATASET 8 WORD 2	0 … 9999	107	1 = 1
92.9 DATASET 8 WORD 3	0 … 9999	106	1 = 1
98 OPTION MODULES			
98.1 ENCODER MODULE	NTAC; NO; RTAC-SLOT1; RTAC-SLOT2; RTAC-DDCS	NO	1 = 1 (0 … 4)
98.2 COMM. MODULE	NO; FIELDBUS; ADVANT	NO	1 = 1 (1 … 3)
98.3 CH3 NODE ADDR	1 ... 254	1	1 = 1
98.4 CH0 NODE ADDR	0 … 125	1	1 = 1
98.5 DI/O EXT MODULE 1	NDIO; NO; RDIO-SLOT1; RDIO-SLOT2; RDIO-DDCS	NO	1 = 1 (1 … 5)
98.6 DI/O EXT MODULE 2	NDIO; NO; RDIO-SLOT1; RDIO-SLOT2; RDIO-DDCS	NO	1 = 1 (1 … 5)
98.7 AI/O EXT MODULE	NAIO; NO; RAIO-SLOT1; RAIO-SLOT2; RAIO-DDCS	NO	1 = 1 (1 … 5)

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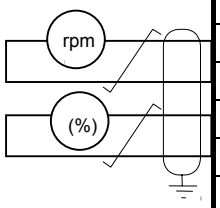
Appendix B - User I/O Interface diagrams

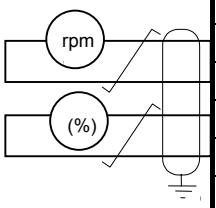
The Figures in this appendix shows typical signal connections at the RMIO board I/O, for the different control modes.



Terminal Block **X16**		**RMIO board**
1	-REF	Negative reference voltage –10V, max. 10 mA
2	AI GND	
Terminal Block **X21**		***Analogue signals***
1	VREF	Positive reference voltage +10V, max. 10 mA
2	GND	
3	AI1+	Speed Reference (voltage 0(2)…+10V)
4	AI1-	
5	AI2+	Torque Reference (current 0…20 mA)
6	AI2-	
7	AI3+	Speed Limit, par. 20.10 (current 0(4)…20 mA)
8	AI3-	
9	AO1+	Motor Speed
10	AO1-	0…20 mA == 0…100 % Motor speed
11	AO2+	Motor Torque
12	AO2-	0…20 mA == 0…Motor Nominal Torque
Terminal Block **X22** ***Digital Inputs***		
1	DI1	Brake Acknowledge (default)
2	DI2	Zero Position (default)
3	DI3	Start Direction A = Up or Forward
4	DI4	Start Direction B = Down or Backward
5	DI5	Slowdown-N (default)
6	DI6	Fast Stop-N (default)
7	+24 VDC	+24 VDC max. 100 mA
8	+24 VDC	
9	DGND	Digital ground
10	DGND	Digital ground
11	DI_IL (DI7)	*programmable input, see Group10*
Terminal Block **X23**		
1	+24 V DC	Aux. voltage output 24V 250 mA
2	GND	
Terminal Block **X25** ***Digital Outputs***		
1	RO11	***Relay Output 1***
2	RO12	**Brake Lift (default)**
3	RO13	
Terminal Block **X26**		
5	RO21	***Relay Output 2***
6	RO22	**Watchdog-N (default)**
7	RO23	
Terminal Block **X27**		
5	RO31	***Relay Output 3***
6	RO32	**Fault-N (default)**
7	RO33	

Use external power supply, if the total current consumption exceeds 250 mA

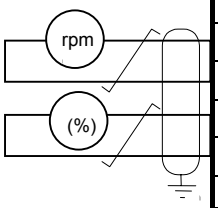
Figure B-1: Connections at the RMIO board in Stand Alone mode, Joystick control.



Terminal Block **X16**		**RMIO board**
1	-REF	Negative reference voltage –10V, max. 10 mA
2	AI GND	
Terminal Block **X21**		***Analogue signals***
1	VREF	Positive reference voltage +10V, max. 10 mA
2	GND	
3	AI1+	*not used*
4	AI1-	
5	AI2+	*not used*
6	AI2-	
7	AI3+	Speed Limit, par. 20.10 (current 0(4)…20 mA)
8	AI3-	
9	AO1+	Motor Speed
10	AO1-	0…20 mA == 0…100 % Motor speed
11	AO2+	Motor Torque
12	AO2-	0…20 mA == 0…Motor Nominal Torque
Terminal Block **X22** ***Digital Inputs***		
1	DI1	Brake Acknowledge (default)
2	DI2	Increase (= Accelerate)
3	DI3	Start Direction A = Up or Forward
4	DI4	Start Direction B = Down or Backward
5	DI5	Slowdown-N (default)
6	DI6	Fast Stop-N (default)
7	+24 VDC	+24 VDC max. 100 mA
8	+24 VDC	
9	DGND	Digital ground
10	DGND	Digital ground
11	DI_IL (DI7)	*programmable input, see Group10*
Terminal Block **X23**		
1	+24 V DC	Aux. voltage output 24V 250 mA
2	GND	
Terminal Block **X25** ***Digital Outputs***		
1	RO11	***Relay Output 1***
2	RO12	**Brake Lift (default)**
3	RO13	
Terminal Block **X26**		
5	RO21	***Relay Output 2***
6	RO22	**Watchdog-N (default)**
7	RO23	
Terminal Block **X27**		
5	RO31	***Relay Output 3***
6	RO32	**Fault-N (default)**
7	RO33	

Use external power supply, if the total current consumption exceeds 250 mA

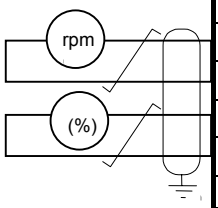
Figure B-2: Connections at the RMIO board in Stand Alone mode, Motor Pot control.



Terminal Block **X16**		**RMIO board**
1	-REF	Negative reference voltage –10V, max. 10 mA
2	AI GND	
Terminal Block **X21**		***Analogue signals***
1	VREF	Positive reference voltage +10V, max. 10 mA
2	GND	
3	AI1+	*not used*
4	AI1-	
5	AI2+	*not used*
6	AI2-	
7	AI3+	Speed Limit, par. 20.10 (current 0(4)…20 mA)
8	AI3-	
9	AO1+	Motor Speed
10	AO1-	0…20 mA == 0…100 % Motor speed
11	AO2+	Motor Torque
12	AO2-	0…20 mA == 0…Motor Nominal Torque
Terminal Block **X22** ***Digital Inputs***		
1	DI1	Brake Acknowledge (default)
2	DI2	*programmable input, see Group10*
3	DI3	Start Direction A = Up or Forward
4	DI4	Start Direction B = Down or Backward
5	DI5	Slowdown-N (default)
6	DI6	Fast Stop-N (default)
7	+24 VDC	+24 VDC max. 100 mA
8	+24 VDC	
9	DGND	Digital ground
10	DGND	Digital ground
11	DI_IL (DI7)	*programmable input, see Group10*
Terminal Block **X23**		
1	+24 V DC	Aux. voltage output 24V 250 mA
2	GND	
Terminal Block **X25** ***Digital Outputs***		
1	RO11	***Relay Output 1***
2	RO12	**Brake Lift (default)**
3	RO13	
Terminal Block **X26**		
5	RO21	***Relay Output 2***
6	RO22	**Watchdog-N (default)**
7	RO23	
Terminal Block **X27**		
5	RO31	***Relay Output 3***
6	RO32	**Fault-N (default)**
7	RO33	

Use external power supply, if the total current consumption exceeds 250 mA

Figure B-3: Connections at the RMIO board in Stand Alone mode, Radio Control.



Terminal Block **X16**		**RMIO board**
1	-REF	Negative reference voltage –10V, max. 10 mA
2	AI GND	
Terminal Block **X21**		***Analogue signals***
1	VREF	*Positive reference voltage +10V, max. 10 mA*
2	GND	
3	AI1+	*not used*
4	AI1-	
5	AI2+	*not used*
6	AI2-	
7	AI3+	Speed Limit, par. 20.10 (current 0(4)…20 mA)
8	AI3-	
9	AO1+	Motor Speed
10	AO1-	0…20 mA == 0…100 % Motor speed
11	AO2+	Motor Torque
12	AO2-	0…20 mA == 0…Motor Nominal Torque
Terminal Block **X22** ***Digital Inputs***		
1	DI1	Brake Acknowledge (default)
2	DI2	Power On Ackn (programmable input)
3	DI3	Sync (programmable input)
4	DI4	*programmable input, see Group10*
5	DI5	*programmable input, see Group10*
6	DI6	*programmable input, see Group10*
7	+24 VDC	+24 VDC max. 100 mA
8	+24 VDC	
9	DGND	Digital ground
10	DGND	Digital ground
11	DI_IL (DI7)	*programmable input, see Group10*
Terminal Block **X23**		
1	+24 V DC	Aux. voltage output 24V 250 mA
2	GND	
Terminal Block **X25** ***Digital Outputs***		
1	RO11	***Relay Output 1***
2	RO12	**Brake Lift (default)**
3	RO13	
Terminal Block **X26**		
5	RO21	***Relay Output 2***
6	RO22	**Watchdog-N (default)**
7	RO23	
Terminal Block **X27**		
5	RO31	***Relay Output 3***
6	RO32	**Fault-N (default)**
7	RO33	

Use external power supply, if the total current consumption exceeds 250 mA

Figure B-4: Connections at the RMIO board in Fieldbus mode.

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